

**Bonita Peak Mining District
Human Health Risk Assessment
Revision 0**

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Prepared for and with direction by:



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Acronyms and Abbreviations

°F	degrees Fahrenheit
<	less than
≤	less than or equal to
≥	greater than or equal to
μg	microgram
μm	micrometer
%	percent
95UCL	95% Upper Confidence Limit
AALM	All Ages Lead Model
ABA	acid-base accounting
ABS	activity-based sampling
ADAF	age-dependent adjustment factor
AF	absorption fraction
ALM	Adult Lead Methodology
AT	averaging time
ATSDR	Agency for Toxic Substances and Disease Registry
ATV	all-terrain vehicle
BKSF	biokinetic slope factor
BLM	Bureau of Land Management
BW	body weight
C	concentration of chemical
CDC	Center for Disease Control
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
COPC	chemical of potential concern
Cr(III)	trivalent chromium
Cr(VI)	hexavalent chromium
CSM	conceptual site model
CTE	Central Tendency Exposure
dL	deciliter
DI	daily intake
DIL	daily intake averaged over a lifetime
DRI	dietary reference intake
EC	exposure concentration
ED	exposure duration
EF	exposure frequency
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ESAT	Environmental Services Assistance Team
ET	exposure time
EU	exposure unit
FNB	Food and Nutrition Board
g	gram

GM	geometric mean
GSD	geometric standard deviation
HHRA	human health risk assessment
HI	hazard index
HIF	human intake factor
HQ	hazard quotient
IEUBK	Integrated Exposure Uptake Biokinetic Model
IQ	intelligence quotient
IR	intake rate
IRIS	Integrated Risk Information System
IVBA	in vitro bioaccessibility
IWTP	Interim Water Treatment Plant
IUR	inhalation unit risk
kg	kilogram
L	liter
LOAEL	lowest-observed-adverse-effect level
m ³	cubic meter
MDL	method detection limit
mg	milligram
mm	millimeter
NCEA	National Center for Environmental Assessment
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no-observed-adverse-effect level
NPL	National Priorities List
OLEM	Office of Land and Emergency Management
OSWER	Office of Solid Waste and Emergency Response
PbB	concentration of lead in blood
PbB0	baseline blood lead level
PEF	particulate emission factor
PPRTV	Provisional Peer Reviewed Toxicity Value
RAGS	Risk Assessment Guidance for Superfund
RBA	relative bioavailability
RBC	risk-based concentration
RfD	reference dose
RfC	reference concentration
RME	Reasonable Maximum Exposure
RSL	Regional Screening Level
SF	slope factor
Site	Bonita Peak Mining District Site
SPLP	synthetic precipitation leaching procedure
TRW	Technical Review Workgroup
TWA	time-weighted average
TWF	time-weighting factor
UCL	upper confidence limit
UF	uncertainty factor

USFS	U.S. Forest Service
WOE	weight of evidence
WSDOH	Washington State Department of Health
XRF	X-ray fluorescence

Section 1

Introduction

1.1 Purpose

The Bonita Peak Mining District Superfund Site (Site) is located in southwestern Colorado. The Site consists of 48 historic mines or mining-related sources where ongoing releases of metal-laden water and sediments are occurring within the Mineral Creek, Cement Creek, and Upper Animas River drainages in San Juan County. Drainages within the Site contain over 400 abandoned or inactive mines, where large- to small-scale mining operations occurred. San Juan County is comprised of 10 historic mining districts (Colorado Geological Survey 2017). Historic mining districts within the Mineral Creek, Cement Creek, and Upper Animas River drainages include Animas, Animas Forks, Cement Creek, Eureka, Ice Lake Basin, and Mineral Point. Hereafter, the term “mining districts” or “Site” is used to refer to the mining districts within these three drainages. This document is a baseline human health risk assessment (HHRA) for the mining districts. The purpose of this document is to characterize the potential risks to humans, both now and in the future, from exposures to contaminants that may be present in the mining districts, assuming that no steps are taken to remediate the environment or to reduce human contact with contaminated environmental media. The mining districts are primarily used by humans for recreational, occupational, and tribal purposes. The receptor populations of interest for the risk assessment included campers, hikers, hunters, recreational fishermen, all-terrain vehicle (ATV) guides, ATV recreational riders, and county road workers. An addendum to this risk assessment will be developed to evaluate tribal exposures once the necessary exposure data are available.

The results of this assessment are intended to help inform risk managers and the public about current and potential future health risks to humans that may occur as a result of exposure to mining-related contaminants due to recreational and occupational activities, and to help determine if there is a need for action to protect public health at the Site. Site managers will also consider the results of the ecological risk assessment and any regulatory requirements in determining appropriate remedial actions for the Site. As appropriate, discussions and recommendations on how to manage potential risks will be provided in the Feasibility Study. The identification of remedial action levels, which will guide future remediation efforts, will be provided in the Record of Decision.

The methods used to evaluate risks in this HHRA are consistent with current guidelines for human health risk assessment provided by the U.S. Environmental Protection Agency (EPA) for use at Superfund sites (EPA 1989, 1991a, 1991b, 1992, 1997, 2002a, 2002b, 2002c, 2004, 2009a).

1.2 Organization

In addition to this introduction, this report is organized into the following sections:

Site Description and Data Summary:

Section 2 This section provides a description of the Site and a review of data that characterize the nature and extent of environmental contamination in the mining districts.

Risk Evaluation Based on Chronic Exposure:

Section 3 This section identifies human exposure scenarios of potential concern in the mining districts, and identifies chemicals of potential concern (COPCs) for each exposure medium.

Section 4 This section summarizes chronic exposure and risk to humans from non-lead COPCs. This includes a description of the basic methods and data used to evaluate exposure and risk from non-lead chemicals, the estimated cancer and non-cancer risk levels in the mining districts, a discussion of the uncertainties in the evaluation, review of background concentrations, and risk conclusions.

Section 5 This section summarizes chronic exposure and risk to humans from lead. This includes a description of the basic methods and data used to evaluate exposure and risk from lead, the estimated levels of risk, a discussion of the uncertainties in the evaluation, review of background concentrations, and risk conclusions.

Risk Evaluation Based on Acute Exposure:

Section 6 This section summarizes a screening-level acute risk evaluation for humans exposed to arsenic and lead. This includes a description of the basic methods and data used to evaluate exposure and risk, the development and application of the acute screening levels, review of background concentrations, and conclusions.

Conclusions and References:

Section 7 This section provides a summary of the chronic risk conclusions and acute screening-level evaluation based on the information provided in Section 4 through Section 6.

Section 8 This section provides full citations for EPA guidance documents, site-specific documents, and scientific publications referenced in this report.

All tables, figures, and appendices cited in the text are provided at the end of the report.

Section 2

Site Characterization

This section provides a description of the mining districts and watersheds within the Site, a review of data that characterize the nature and extent of environmental contamination in the mining districts, and an overview of response actions performed to date.

2.1 Site Location

The Bonita Peak Mining District Superfund Site is located near Silverton in southwestern Colorado in San Juan County. There are three main drainages (Cement Creek, Mineral Creek, and Upper Animas River) that flow into the Animas River at Silverton, as shown in Figure 2-1. There are over 400 abandoned or inactive mines where mining operations have occurred within these three drainages. The Site consists of 48 historic mines or mining-related sources where ongoing releases of metal-laden water and sediments are occurring within the Mineral Creek, Cement Creek, and Upper Animas River drainages in San Juan County. This HHRA quantifies exposures for the Site within these three drainages; it includes both an evaluation of the 48 historic mines or mining-related sources, along with a broader evaluation of exposures and risks within these three drainages.

The headwaters of the Animas River watershed are in the San Juan and Silverton calderas. The Upper Animas River begins approximately 14 miles northeast of Silverton. The Cement Creek watershed originates in the San Juan Mountains in San Juan County, and is a tributary to the Upper Animas River. Cement Creek is approximately eight miles long, flowing from north to south before the confluence with the Animas River at Silverton. The Animas River flows south from Silverton to Durango, Colorado, crosses into New Mexico, and joins the San Juan River in Farmington, New Mexico. Mineral Creek originates at the top of Red Mountain Pass and flows from north to south approximately 9.3 miles before entering the Animas River southwest of the town of Silverton.

2.2 Site History

The discovery of gold and silver brought miners to the Silverton area and Animas Mining District in the early 1870s. The discovery of silver in the base-metal ores was the major factor in establishing Silverton as a permanent settlement. Between 1870 and 1890, the richer ore deposits were discovered and mined to the extent possible. It was not until 1890 that a serious attempt was made to mine and concentrate the larger low-grade ore bodies in the area. By 1900, there were twelve concentration mills in the valley sending products to the Kendrick and Gelder Smelter near the mouth of Cement Creek. Mining and milling operations slowed down circa 1905, and mines were consolidated into fewer and larger operations with facilities for milling large volumes of ore. After 1907, mining and milling continued throughout the basins whenever prices were relatively favorable.

2.3 Response Actions

On August 5, 2015, EPA was conducting an investigation of the Gold King Mine near Silverton to assess the ongoing water releases from the mine, treat mine water, and assess the feasibility of further mine remediation. While excavating above the collapsed adit, pressurized water began leaking above the mine tunnel, spilling about three million gallons of water stored behind the collapsed portal into Cement Creek.

Following the release, EPA initiated emergency removal actions under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104. Emergency response actions included:

- Installation of the Gladstone Interim Water Treatment Plant (IWTP) in the former townsite of Gladstone, Colorado with a treatment capacity of 1,200 gallons per minute (EPA 2016a)
- Construction of a series of equalization ponds to ensure consistent influent flow rates into the Gladstone IWTP (EPA 2016a)
- Stabilization of the Gold King Mine adit portal entrance with shotcrete and steel reinforcement structures (EPA 2016b)
- Improvement of access road to the Gold King Mine adit portal (EPA 2016b).

Since October 2015, EPA has been treating the discharge from the Gold King Mine at the Gladstone IWTP.

Due to releases of hazardous substances into the environment and potential human and ecological health impacts, EPA proposed 48 historic mine features for addition to the National Priorities List (NPL) on April 7, 2016 (EPA 2016c) and conducted a 68-day public comment period on the proposal. After reviewing and responding to all comments in a responsiveness summary, EPA added the Site to the NPL on September 9, 2016.

2.4 Physical Setting

The Site is situated within the Animas River watershed in a heavily forested area of the San Juan mountains. The elevation of the Site ranges from approximately 9,500 feet to 12,800 feet above mean sea level.

2.5 Climate

The Site has an alpine climate with snowy, cold winters and cool summers. The greatest amount of snowfall is between November and April, with an average snowfall of 12 feet per year (EPA 2016b). Long-term precipitation data are collected from the National Oceanic and Atmospheric Administration (NOAA) weather station at Silverton. The weather station has a latitude of 37.809 N and a longitude of 107.663 W. In 2016, the Silverton station recorded annual precipitation of approximately 19 inches (NOAA 2017). In this alpine climate region, the mean temperatures range from 8 degrees Fahrenheit (°F) to 24°F in January and 36°F to 72°F in July (Chapman et al. 2006).

2.6 Land Use

The land ownership within the mining districts of the Site varies, with land owned privately, by the U.S. Forest Service (USFS), the Bureau of Land Management (BLM), San Juan County, the Town of Silverton, and the State of Colorado. The mining districts are used recreationally in the summer months (mainly between Memorial Day and Labor Day) for a variety of activities, including camping, hiking, hunting, fishing, and riding ATVs. Downhill skiing at Silverton Mountain and Kendall Mountain Ski Area, cross-country skiing, snowshoeing, and snowmobiling (where permitted) are popular activities in the winter.

2.7 Basis for Potential Human Health Concern

Mining sites are generally associated with the occurrence of elevated levels of a number of different metals in solid mine wastes (tailings, waste rock, spilled ore, etc.) and in surface water draining from mine shafts and adits. Excess exposures to metals are known to cause a range of non-cancer and cancer effects in humans. Visitors to the mining districts within the Site boundaries and occupational workers (e.g., roadway workers) therein could be at risk of adverse health effects if excessive exposure to contaminated environmental media were to occur.

2.8 Data Summary

Numerous studies have been performed to investigate and characterize the nature and extent of environmental contamination in the mining districts. For this evaluation, attention was focused on data collected in 2015 and later (EPA 2015a, 2016d, 2016e, 2017a, 2018a). This is because recent data are likely to be more representative of current conditions than older data, and are often better documented. Data were downloaded from the Bonita Peak Mining District Scribe database on March 20, 2019 (version 90) to ensure that the most current data were utilized in preparing this HHRA¹. Appendix A contains a copy of the Bonita Peak Mining District Scribe database, limited to the date range used in this document. The data summary presented below is consistent with this download; any changes made to the Scribe database after this date are not included in this document. Appendix A also contains a list of the samples per medium used in the risk calculations.

For details regarding sampling and analytical methodology of each environmental investigation, refer to the applicable governing documents: EPA 2015a, 2016d, 2016e, 2017a, 2018a. Detailed analytical results are presented in the Sampling Activities Reports for 2015, 2016, and 2017 (EPA 2015b, 2016f, 2018d, respectively). Analytical results for 2018 will be presented in a forthcoming Sampling Activities Report for 2018. Available data are described below, stratified by environmental medium. A detailed data adequacy evaluation of these results, including an evaluation of spatial and temporal representativeness and detection limit adequacy, is presented in Section 4.4.1.4.

¹ Analytical results with an R-qualifier (i.e., data rejected by the data validator) have been excluded from summary statistics. Consequently, the number of results for individual analytes for a medium may vary.

2.8.1 Soil and Mine Waste

With few exceptions, soil and mine waste samples collected from 2015 to 2018 were composite samples. Samples were collected from overbank locations, mine waste deposits/tailings piles, floodplain areas of the Animas River, select road segments, campgrounds, and upland reference locations. The sampling methodology for each soil type is presented. Figure 2-2 through Figure 2-4 present the soil sampling locations for the Animas River, Cement Creek, and Mineral Creek drainages, respectively, for the various soil and waste types described.

Overbank Soils – Overbank soil is riparian sediment that has been deposited on the banks of a river or stream by flood waters. Overbank samples were collected using a 5-point composite technique at a depth of 0-2 inches. Samples were collected from the streambanks' poorly vegetated or un-vegetated soils.

Waste Rock – Waste rock pile samples were collected using either a 30-point composite or 5-point composite technique at a depth of 0-6 inches for each location. In cases where the area was not large enough for a 30-point composite, a 5-point composite was collected.

Floodplain – The floodplain of the Animas River in the area from Kittimack Tailings to Eureka was divided into polygons to investigate contaminant levels in the Kittimack Tailings piles. A 30-point composite sample was collected from each polygon at a depth of 0-6 inches. Test pits were created using a backhoe at several places along the floodplain of the Animas River. Samples were collected from each test pit at depths of 0–6 inches, 6–18 inches, and 18–30 inches. Because floodplain tailings samples were collected from tailing deposits, they were evaluated similar to waste rock in the exposure assessment and risk characterization.

Roadway Soils – Unpaved roads were sampled with a 5-point composite across the road, perpendicular to travel, and samples were collected from a depth of 0-2 inches at each point along the transect within the roadway. The majority of roadway samples were collected in 2016, with a portion of the roadway along the Animas River sampled in 2018 to fill a gap in the 2016 sampling.

Camping Area Soils – Campground soil samples were collected using either a 30-point or 5-point composite, depending on size of the campground. Samples were collected from a depth of 0-2 inches using plastic scoops after breaking up the soil with a shovel. Samples were collected from 14 campgrounds in 2016, including the USFS South Mineral Campground (hereafter referred to as the USFS campground) and 13 “dispersed” campsites in designated backcountry areas located in the mining districts². A dispersed campsite is an area that is suitable for camping or where camping is known to occur, but may not be a formal campground. Dispersed campsites identified for sampling were those where campers had frequently been observed to be present. Campground samples were collected again in 2018 from select campgrounds to gather bioavailability data and better document the extent of the sampling area using the Global Positioning System. For those campsites where samples were collected in both 2016 and 2018,

² Four of the dispersed campsites were resampled in July 2018 to collect samples for in vitro bioaccessibility (IVBA) analysis and to better characterize the campsite exposure area. These locations were selected because they had higher concentrations relative to the remaining dispersed campsites measured in the initial campsite sampling conducted in 2016.

the samples collected in 2018 have been used in preference to the samples collected in 2016 because they are more representative of the expected exposure area.

Upland Reference Locations – Upland areas, located upgradient of contamination sources at the Site, were sampled using composite sampling. Fifteen subsamples were randomly collected to comprise the composite sample. Only natural, non-developed areas not likely to be impacted by roads, and other anthropogenic features that might be sources of contamination, were selected. A range of different upland vegetation communities consisting of subalpine forests and meadows and alpine meadows were sampled. In total, 34 samples were collected from 7 unique areas (2 areas within the Animas River watershed, 2 areas in the Cement Creek Watershed, 2 areas within the Mineral Creek watershed, and 1 in the Cunningham Creek³ drainage).

Soil and waste material samples were homogenized and sieved using a No. 10 sieve with a 2-millimeter (mm) opening at EPA's Environmental Services Assistance Team (ESAT) Region 8 laboratory in Golden, Colorado. Ten percent (%) of each sample type (i.e., waste rock, campground, and roadway soils) were also sieved using a No. 60 mesh sieve with a 250-micrometer (µm) opening because inorganics have been shown to concentrate in the fine fraction and this fraction is most likely to adhere to skin and be ingested (EPA 2000). Samples were analyzed for total recoverable metals, mercury, synthetic precipitation leaching procedure (SPLP), and acid-base accounting (ABA). Twenty-eight samples from a range of soil types, including waste rock, roadway soils, and dispersed campsite soils, were sent to the University of Colorado, Laboratory for Environmental and Geological Studies for IVBA analysis of arsenic and lead (see Section 4.1.4 and Section 5.2.4, respectively, for additional information on the IVBA results). Table 2-1 presents summary statistics for all soil samples collected within the mining districts that were analyzed for total recoverable metals and mercury. Summaries of the SPLP and ABA results are presented in their respective Sampling Activities Reports, however, these results are not used in this HHRA.

For the purposes of risk characterization, soil/mine waste samples were restricted to include only those collected from 0-2 inches or 0-6 inches because receptors are most likely to be exposed to contaminants present in surficial material (see Section 3.2.1 for more information on soil/waste material exposure depth interval).

2.8.2 Sediment

Composite sediment samples were collected from 2015 to 2018 and analyzed for total recoverable metals and mercury. Sediment samples were collected from a depth of 0 to 1 inches in shallow aqueous areas up to 12 inches in depth. Several sediment subsamples were collected from a stream segment 50 meters upstream to 50 meters downstream of the actual sampling location. The subsamples were combined and homogenized in the field after collection. Figure 2-5 through Figure 2-7 present the sediment sampling locations within the Animas River, Cement Creek, and Mineral Creek drainages, respectively. Table 2-2 presents summary statistics for all sediment samples collected within the mining districts.

³ Cunningham Creek flows north, joining the Animas River downgradient from Howardsville, Colorado.

2.8.3 Surface Water

Grab surface water samples were collected from 2015 to 2018 at locations along the Animas River, Cement Creek, Mineral Creek, Eureka Gulch, several adits, and smaller tributaries and analyzed for dissolved and total recoverable metals and several water quality parameters. Figure 2-5 through 2-7 present the surface water sampling locations within the Animas River, Cement Creek, and Mineral Creek drainages, respectively. Table 2-3 presents summary statistics for total recoverable metals in all surface water samples collected within the mining districts. Total recoverable metal concentrations are presented in preference to the dissolved concentrations because this is the fraction most representative of human health exposures from ingestion of surface water.

2.8.4 Groundwater

Two groundwater samples have been collected from a known drinking water source at the USFS campground. These samples were collected from the USFS campground in 2010⁴ and 2017. Table 2-4 presents summary statistics for the groundwater samples collected at the USFS campground.

Although other groundwater samples were collected in 2016 through 2018, these were collected from monitoring wells that are not used as a drinking water source and were not included in the risk estimates.

2.8.5 Fish Tissue

In 2016, fish tissue samples were collected from three locations within the mining districts (Animas Above Cunningham, South Fork of Mineral Creek, and Mineral Creek below Mill Creek) and two reference locations (Maggie Gulch, Mill Creek). Figure 2-8 presents the fish sampling locations. As seen, locations where fish were captured and tissue was collected for analysis are denoted with green symbols. Twenty-three fish were collected using electroshocking and fillet tissues were analyzed for total recoverable metals and mercury. Locations where fish were captured but tissue was not collected for analysis are denoted with orange symbols. In some locations, fish were not captured, as indicated by red symbols. All fish collected were brook trout (*Salvelinus fontinalis*). The collected fish were categorized as edible, subedible, and forage, depending on size. Table 2-5 presents summary statistics for total recoverable metals and mercury in edible fish fillet tissue samples, because these samples represent the fish size and tissue type that human receptors are likely to ingest.

2.8.6 Game Tissue

In 2017, game tissue samples from three dusky grouse (*Dendragapus obscurus*) and two mule deer (*Odocoileus hemionus*) were collected. Figure 2-9 presents the game sampling locations. Both organ and muscle tissues were collected and analyzed for total recoverable metals and mercury. However, the risk characterization only evaluated exposures from muscle tissues, as this represents the type of tissue that human receptors are likely to ingest most frequently.

⁴ One groundwater sample was collected in 2010 from the USFS campground. Because data for drinking water are so sparse, this is the only sample used in this risk evaluation collected prior to 2015. The results for this sample are not in the Scribe database but were provided by USFS.

Tables 2-6 and 2-7 present summary statistics for grouse samples (breast tissue) and deer samples (back strap, front roast, rear roast, and tenderloin cuts), respectively.

2.8.7 Roadway Air

In fall 2017, nine stationary roadway air samples were collected from lower elevation, unpaved earthen roads in the mining districts. Samples were collected over an 8-hour period with a fixed volumetric flow rate of 2.75 liters per minute. The sampling pumps (cyclones) were set up as close to the road as possible and placed on a pedestal so the intake port was 6 feet above the ground surface (i.e., the approximate breathing height of an adult roadway worker). Figure 2-10 presents the roadway air sampling locations. The roadway air samples were analyzed for arsenic, chromium, manganese, and lead. Table 2-8 presents summary statistics for roadway air samples.

2.8.8 ATV Activity-Based Sampling Air

In fall 2018, ATV activity-based sampling (ABS) was performed on select routes within the mining districts frequented by ATV guides and ATV recreational riders. The ATV ABS was conducted with single operators on two ATVs driven on two routes (the Alpine Loop and a remote roadway), as depicted in Figure 2-11. The operators wore air filter cassettes that sampled air concentrations within their breathing zone while driving. Sixteen ABS air samples were collected and analyzed for total recoverable metals. Table 2-9 presents summary statistics for ATV ABS air samples.

2.9 Data Validation

Based on the governing documents (EPA 2015a, 2016d, 2016e, 2017a, 2018a), 10% of the analysis results were validated. Validation was performed in accordance with the EPA Contract Laboratory Program (CLP) *National Functional Guidelines for Inorganic Superfund Methods Data Review* (EPA 2017b). All data presented in the data summary were deemed valid and appropriate for use in the risk assessment with the exception of R-qualified (rejected) analytical results. Any analytical results that were R-qualified by the data validator were excluded from any exposure and risk calculations. Although R-qualified results were infrequently reported, antimony, selenium, and thallium were more frequently rejected for soil samples. Likewise, R-qualified results for mercury in surface water were more frequently rejected. Adequacy of spatial and temporal representativeness, given the exclusion of rejected analyses, is presented in the uncertainty discussion (see Section 4.4.1).

For a subset of soil samples, multiple analytical results are available in the database. These soil samples were analyzed by two laboratories: EPA's ESAT Region 8 laboratory and a CLP laboratory. Analytical results provided by the ESAT laboratory were used in preference to the CLP laboratory because of a lower frequency of qualifiers.

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Section 3

Exposure Assessment

Exposure is the process by which humans come into contact with chemicals in the environment. In general, humans can be exposed to chemicals in a variety of environmental media (e.g., soil, sediment, water, air, or food), and these exposures can occur through several pathways (e.g., ingestion, dermal contact, or inhalation).

3.1 Site Conceptual Model

Figure 3-1 presents the conceptual site model (CSM) for human exposures in the mining districts. The CSM summarizes EPA's current understanding of how chemical contaminants that have been released to the environment might result in exposure of human receptors. The main features of this CSM and the rationalization supporting decisions about the receptors and pathways identified for risk quantification in the HHRA are discussed below.

3.1.1 Primary Sources of Contamination

The Site consists of historic mines and mining-related sources that have resulted in the direct deposition of various types of solid wastes (tailings and waste rock) that were placed onto soil near the mines or were discharged into nearby streams. In addition, contaminated water from mine adits also discharges directly into streams. There are three primary drainages within the Site, including Mineral Creek, Cement Creek, and the Upper Animas River (Figure 2-1). Metals are the primary COPCs at the Site.

3.1.2 Transport in the Environment

Chemical contaminants released from historic mining operations may migrate in the environment by several processes:

- Fine-grained soil/solid waste particulates may be released into air as a consequence of either wind erosion and/or human disturbances (e.g., ATV use).
- Soil/solid wastes may be eroded into streams, resulting in contamination of both surface water and stream sediments.
- Adit discharges may be released into streams, resulting in contamination of both surface water and stream sediments.
- Contaminants in soil, sediment, or surface water may be taken up into the tissues of plants and animals (game and fish).
- Contaminants in soil/solid wastes may be dissolved by water (rain or snowmelt) and enter surface water via run-off, resulting in contamination of both surface water and stream sediments.

- Contaminants in soil/solid wastes may be dissolved by water (rain or snowmelt) and infiltrate into subsurface soils and migrate downward into groundwater.
- Groundwater may interact with streams, resulting in contamination of both surface water and stream sediments.

3.1.3 Populations of Chief Concern

Currently, the mining districts are primarily used for recreational, occupational, and tribal purposes. Risks to on-site remediation workers and nearby residences will not be quantified. Future land uses are expected to be consistent with current use. Based on this expectation, the human populations most likely to be exposed are identified below.

ATV Guides/Recreational Rider: ATV use is likely to result in higher than average exposures to contaminated soils, both by incidental ingestion of soil and by inhalation of dust particles that are released from soil into air by the riding activity. Both a high-end exposure scenario (ATV guide) and average exposure scenario (ATV recreational rider) were evaluated in the HHRA. For the ATV guide, the receptors of interest are adults. The ATV recreational rider population is assumed to include older children (ages 6–16 years old) and adults. Note that four-wheel-drive vehicle riders could also be exposed by the same exposure routes; however, because exposure is expected to be greater for an ATV recreational rider compared to a Jeep rider, Jeep rider exposures have been conservatively represented by the ATV recreational rider.

Hiker: The hiker was selected to represent a typical exposure at the Site. The hiker population is assumed to include older children (ages 6–12 years old) and adults.

Camper: Camping along the drainages and in the USFS campground is thought to be a reasonable current or future land use. There is one established campground, the USFS campground, and multiple locations of dispersed campsites in designated backcountry areas throughout the mining districts. It is assumed that people who camp include children (less than 6 years old), older children (ages 6–16 years old), and adults.

Recreational Fisherman: The recreational fisherman population represents individuals who may fish along streams in the mining districts and includes older children (ages 6–16 years old) and adults. Whitewater rafters or kayakers could also be exposed by similar exposure routes. Because exposure frequency is expected to be greater for the fisherman, because more areas at the Site are suitable for fishing than rafting or kayaking, these exposures have been conservatively represented by the fisherman.

Hunter: The hunter population represents individuals who may hunt and ingest wild game in the mining districts. The hunter population is assumed to include older children (ages 6–16 years old) and adults.

County Road Worker: County road workers represent individuals that perform road maintenance along county roads within the mining districts. For the road worker, the receptors of interest are adults.

Tribal Member: The tribal population represents individuals from the Southern Ute Indian Tribe, Ute Mountain Ute Indian Tribe, and Ute Indian Tribe who may access the mining districts to

harvest plants for medicinal purposes, wild foods that are gathered and consumed (e.g., shoots, berries), and willows for weaving. Consultation is underway to determine if the Jicarilla Apache and Navajo Nation Tribal members also access the mining districts for similar gathering activities. The tribes may utilize the mining districts to exercise their hunting and gathering rights under the Brunot Agreement. An addendum to this risk assessment will be developed to evaluate tribal exposures once the necessary exposure data are available.

3.2 Exposure Pathways of Chief Concern

Not all exposure pathways for these human populations are likely to be of equal concern. First, to be of concern, an exposure pathway must be “complete.” That is, there must be contact between a human receptor and a contaminated environmental medium. For pathways that are complete, the relative importance of one to another is related to the amount of chemical taken into the body by each pathway. Complete exposure scenarios that may be significant are shown in Figure 3-1 by boxes containing a solid circle. In the HHRA, attention is focused on quantification of exposure from these pathways to determine if resulting risk is unacceptable. Complete exposure scenarios likely to be minor contributors to total exposure and risk are shown in Figure 3-1 by boxes containing an “X.” For some minor pathways (identified by footnote 6), a semiquantitative evaluation was performed to support this designation. For example, for ingestion of surface water, illustrative calculations were performed, using risk estimates for the maximally exposed receptor (i.e., camper) and information on the relative exposure frequency/duration of other receptors (e.g., hiker, hunter) to the camper, to demonstrate potential risks to these receptors are likely to be similar to (or lower than) the camper. For the remaining minor pathways (identified with an “X” and no footnote) such as dermal exposures with soil, a qualitative evaluation was performed in the risk assessment to support the designation.

The following sections present a more detailed description of these pathways and an analysis of their relative importance for human exposure.

3.2.1 Exposures to Soil/Solid Wastes

In general, most recreational and occupational activities that may be conducted at the Site, such as hiking, hunting, and riding, would most likely only come into contact with soils and waste materials at the surface (i.e., within the upper 6 inches) and not at deeper depths. Because samples have been collected under a variety of sampling designs, which used a range of different depth intervals, all samples with a bottom depth of 6 inches or less were used to evaluate exposures to receptors from soil or soil-like⁵ media.

Incidental Ingestion of Surface Soil

Even though few people intentionally ingest soil, anyone who has direct contact with contaminated surface soil may incidentally ingest small amounts that adhere to their hands during outdoor activities. Incidental ingestion of soil is often one of the most important routes of human exposure, so ingestion of surface soil was evaluated quantitatively for most receptors.

⁵ In this section, the term “soil” is used for simplicity, but should be interpreted to represent both soil and soil-like waste materials (e.g., tailings and waste rock materials).

Dermal Contact with Surface Soil

Receptors may have dermal exposure to contaminated soil. Even though information is limited on the rate and extent of dermal absorption of metals in soil across the skin, most scientists consider this pathway is likely to be minor in comparison to the amount of exposure that occurs by the oral route. This view is based on the recognition that most metals tend to bind to soils (reducing the likelihood that they would dissociate from the soil and cross the skin), and ionic species such as metals have a relatively low tendency to cross the skin even when contact does occur. Based on this, and recognizing current methods and data are very limited for attempting to quantify dermal absorption of chemicals from soil, dermal contact with soil is not evaluated quantitatively, but is identified as a potential source of uncertainty.

Inhalation of Airborne Soil Particulates

Whenever contaminated soils are exposed at the surface, fine-grained particles may become suspended in air by wind and/or human activity and humans in the area could inhale those particles. In cases where the soil is disturbed only by wind or light human activity (e.g., walking/hiking), the amount of particulate material inhaled from air is generally quite small compared to the amount that is typically assumed for incidental ingestion. Therefore, inhalation of soil particulates generated by wind erosion or walking is considered a minor pathway for most receptors.

When surface soil is disturbed by mechanical forces, such as during ATV use, dust levels in air may be significant and intake of soil from inhalation of airborne dusts may become similar to, or even higher than, the ingestion pathway. Thus, inhalation of soil particulates generated during ATV use was evaluated quantitatively.

For county road workers, dust levels in air generated through disturbance of roadway soils may be significant. Because air concentrations include fugitive dust emissions generated from roadway activity and wind disturbance, both transport mechanisms were evaluated quantitatively.

3.2.2 Exposures to Sediment

Incidental Ingestion of Sediment

Receptors are unlikely to intentionally ingest sediment, but, as described above for surface soil, individuals having direct contact with contaminated sediments may incidentally ingest small amounts that adhere to their hands during recreational activities along streams (e.g., fishing, rafting, or playing). Thus, incidental ingestion of sediment was evaluated for campers and recreational fishermen because these two populations are likely to interact most with streams in the mining districts.

Dermal Contact with Sediment

Receptors who come into contact with contaminated sediments may get some of the material on their skin during recreational activities along streams. Similar to dermal contact with soil, dermal contact with sediment was not evaluated quantitatively but is identified as a potential source of uncertainty.

3.2.3 Exposures to Surface Water

Ingestion of Surface Water

It is not expected that most visitors in the mining districts will intentionally ingest surface water. However, campers could ingest water from creeks as drinking water and incidental ingestion of water might occur during recreational activities (e.g., camping, fishing, rafting, swimming/bathing). Based on this, ingestion of surface water as drinking water and incidental ingestion of surface water were evaluated for campers at the dispersed campsites. At the USFS campground, incidental ingestion of surface water was evaluated for campers, but it was assumed groundwater from the campground well would be ingested as the primary drinking water source (see Section 3.2.4). Incidental ingestion of surface water was also evaluated for the fishermen.

Dermal Contact with Surface Water

Visitors to the mining districts may have occasional dermal contact with surface water while recreating along the streams. Similar to dermal contact with soils or sediments (discussed above), uptake of metals across the skin from contact with water is usually thought to be a minor exposure pathway because of the relatively low tendency of metals to cross the skin even when contact does occur. For this reason, this pathway was not evaluated. However, exclusion of this pathway is identified as a source of potential uncertainty.

3.2.4 Exposures to Groundwater

While groundwater is not typically accessible to recreational and occupational receptors within the mining districts, a well pump located at the USFS campground could be used as a drinking water source. Based on this, ingestion of groundwater as drinking water was evaluated for campers at the USFS campground.

3.2.5 Exposures to Terrestrial and Aquatic Biota

Ingestion of Wild Game

Big game animals (e.g., deer, elk, or bear) and terrestrial birds (e.g., grouse) that inhabit the mining districts may take up contaminants either from eating vegetation grown in contaminated soils and/or by incidental ingestion of soil while feeding. Contaminants may accumulate in animal muscle and organ tissues. Consequently, hunters ingesting the meat of game animals harvested from the mining districts may be exposed, and this pathway was retained for quantitative evaluation.

The types of hunting within the three watersheds of interest in the mining districts is expected to be focused on large game mammals, such as deer and elk. Inspection of historical small game harvest records provided by Colorado Parks and Wildlife (2018) indicates small game (e.g., rabbits or squirrels) is not typically harvested by hunters in San Juan County. Additionally, it is expected the type of bird hunting within three watersheds of interest in the mining districts, which are characterized by high mountain creeks and rivers, would be more focused on upland terrestrial game such as grouse or pheasant and not waterfowl.

Ingestion of Fish from Area Creeks

Fish living in streams within the mining districts may take up contaminants from surface water, sediment, or the diet into their tissues, leading to exposure of humans who eat fish caught from the contaminated waters. Thus, this pathway was evaluated quantitatively for recreational fishermen.

3.3 Exposure Units

An exposure unit (EU), also referred to as an exposure area, is an area where a receptor may be exposed to one or more environmental media over a specified period of time (e.g., lifetime). In general, receptors are assumed to move about at random within an exposure unit. There are multiple receptor populations of interest, including ATV guides, ATV recreational riders, hikers, fishermen, hunters, campers, and county road workers⁶. Figure 3-1 identifies the exposure media and exposure pathways for each receptor. For the purposes of evaluating receptor exposures, the mining districts are divided into EUs relative to the receptor use, as presented in Figure 3-2 through Figure 3-5.

3.3.1 Hiker, Hunter, and County Road Worker

The county road worker, hiker, and hunter are anticipated to be exposed to media along the drainages because access to the mining districts is obtained along roads that follow waterways. Because the mining districts encompass a large area, they have been subdivided into drainage-specific exposure units for these receptors. Due to its size, the Animas River drainage is subdivided into two reaches: EU1, the section of the Animas River upstream of the confluence of the south fork of the Animas River, and EU2, the section of the Animas River above the main stem of Cement Creek but downstream of the confluence of the south fork of the Animas River. Cement Creek (EU3) and Mineral Creek (EU4)⁷ comprise the remaining EUs for these receptors. EU1 through EU4 are shown in Figure 3-2.

3.3.2 ATV Guide and ATV Recreational Rider

The ATV guide is anticipated to primarily use the Alpine Loop for the majority of their riding time because it is well suited for ATV tours. The Alpine Loop has been designated as EU5a (see the red ATV route in Figure 2-11). The ATV recreational rider is anticipated to use all roadways within the mining districts. For this reason, all roadways were considered to comprise the EU for the ATV recreational rider (EU5b). Roadway soil sampling locations within EU5a and EU5b are depicted in Figure 3-3.

3.3.3 Camper

As noted above, there is one established campground, the USFS campground, and multiple locations of dispersed campsites in designated backcountry areas located within the mining districts. Because the exposure media (i.e., the drinking water source) and the style of camping (managed campground with facilities versus dispersed backcountry campsites) differ for each

⁶ Residential land use and developed areas such as the town of Silverton were not evaluated as part of this HHRA.

⁷ The roadway along Mineral Creek is paved; however, there are dirt roads within the drainage that were used to evaluate risk to the roadway worker in EU4.

type of campground, these have been evaluated as separate EUs. The USFS campground has been designated as EU6 and the collective⁸ dispersed backcountry campsite locations have been designated as EU7, as shown in Figure 3-4.

3.3.4 Recreational Fisherman

Because fish presence and availability of fish tissue samples representative of the Site are limited to Mineral Creek and the lower section of the Animas River, the EUs for the recreational fisherman are limited to Mineral Creek (EU8) and the lower section of the Animas River (EU9), as shown in Figure 3-5.

3.4 COPC Selection

COPCs are chemicals that exist in the environment at concentrations that might be of potential health concern to humans and that are or might be derived, at least in part, from source areas within the mining districts.

3.4.1 COPC Selection Process

The procedure used to identify COPCs for the evaluation of risks to human receptors from potentially contaminated environmental media (soil, sediment, surface water, groundwater, fish tissue, game tissue, and air) is shown in Figure 3-6. This COPC selection procedure is intended to be conservative; that is, it is expected that some chemicals may be identified as COPCs that are of little or no concern but no chemicals of authentic concern will be overlooked.

In brief, the COPC selection procedure classifies each analyte into one of three categories:

- COPC
- Not a COPC
- Source of Uncertainty

The COPC selection procedure compares the maximum detected concentration for each analyte in each medium to a risk-based concentration (RBC). An RBC is a concentration of a chemical in a medium that is believed to pose negligible health risk to a specified population of human receptors. For carcinogens, this is a concentration that corresponds to a cancer risk of 1E-06. For non-carcinogens, this is a concentration that corresponds to a hazard quotient (HQ) of 0.1. (See Section 4.3.1 for information on the how cancer risks and HQs are expressed and interpreted.)

If the maximum detected concentration exceeds the RBC, the chemical is selected as a COPC. If the maximum detected concentration does not exceed the RBC, the chemical is unlikely to pose any health risk even to maximally exposed individuals, and it is not selected as a COPC.

If the chemical was not detected in any of the samples, then the detection limit is evaluated as part of the uncertainty evaluation (see Section 4.4.1). If the detection limit was below the RBC, then the chemical is unlikely to be of concern and is excluded as a COPC. However, if the detection limit was above the RBC, this is identified as a source of uncertainty.

⁸ It is assumed multiple backcountry sites could be visited throughout the year; therefore, the datasets across sites were combined for the purposes of deriving chronic exposure estimates.

If a chemical does not have an RBC, this is identified as a source of uncertainty unless the chemical is a beneficial nutrient and the expected intake (because of exposures from sources in the mining districts) is within the range that is considered healthful (see Section 3.4.3).

For media types for which RBC values were not available (i.e., tissues, air), the list of COPCs for associated media was used to identify COPCs for those media type. If a chemical was selected as a COPC for soil, it was also retained as a COPC for game tissue and air. If a chemical was selected as a COPC for surface water or sediment, it was retained as a COPC for fish tissue. In addition, chemicals that are bioaccumulative in tissue (e.g., mercury) were automatically retained as COPCs.

3.4.2 Source of RBC Values

For this assessment, RBC values for use in the COPC selection were obtained from EPA's Regional Screening Level (RSL) tables (EPA 2018b) using default values that are protective of industrial worker exposures to soil and residential exposures to tap water. Soil and sediment were screened using industrial soil RSLs and surface water and groundwater were screened using residential tap water RSLs. This choice of RBC values for COPC selection is likely to be conservative for recreational and occupational receptors who are likely to have lower exposure frequencies than industrial workers and residents.

Although measured chromium concentrations in environmental media were based on total chromium, for the purposes of COPC selection, maximum concentrations were compared to RSLs based on hexavalent chromium, which is the more toxic form.

3.4.3 Evaluation of Beneficial Minerals

A number of metals are beneficial minerals, meaning a certain level of intake is required to maintain good health. This includes calcium, chromium, copper, iron, magnesium, manganese, molybdenum, potassium, selenium, sodium, and zinc (Food and Nutrition Board [FNB] 2013). However, excess intake of these minerals may cause adverse effects. If EPA has established an RBC for such minerals, they were evaluated as described above; however, because of their low toxicity (even at high doses), EPA has not derived RBC values for some, including calcium, magnesium, potassium, and sodium. These four analytes were evaluated by calculating an effective RBC, as follows:

$$\text{Effective RBC} = \text{DRI} / \text{DI}$$

where:

DRI = Dietary reference intake by a child (milligrams [mg]/day), derived from the FNB (2013)

DI = Daily intake of medium (kilograms [kg]/day of soil, or liters [L]/day of water)

If the average concentration in media did not exceed the effective RBC, the chemical was excluded as a COPC.

3.4.4 Results

The application of this COPC selection process to the data available from the mining districts is presented in Table 3-1 through Table 3-4. Note, the dataset used for COPC selection was restricted to the data representative of the various exposure units. For example, surface water data collected from seeps, springs, mine adits, etc. have not been included in the COPC selection because these surface water sources are not representative of the surface water that receptors are likely to be exposed to. The results of the COPC selection are summarized in Table 3-5 and described below.

The exposure media that require quantitative assessment include soil, sediment, and surface water for multiple metals, including lead. For groundwater, only chromium requires quantitative evaluation. As noted above, the COPCs for air and game tissue are the same as those for soil, and the COPCs for fish tissue are the same as those for surface water and sediment. Mercury was added as a COPC to fish and game tissue because it is bioaccumulative.

Because metals occur naturally in the environment, it is expected some fraction of the concentrations present in the environment may be because of natural background and are not mining-related. However, consistent with EPA guidance on the *Role of Background in the CERCLA Cleanup Program* (EPA 2002d), all COPCs are retained for further evaluation in the risk characterization, regardless of source. Comparisons to background and background risks are discussed as part of the risk characterization to provide a frame of reference for interpreting Site risks.

There were multiple metals in the aqueous media for which all sample results were non-detect. For surface water samples, all mercury analytical results were non-detect. For groundwater samples, aluminum, antimony, arsenic, beryllium, cadmium, iron, manganese, and selenium analytical results were all non-detect. The chemicals listed for surface water and groundwater that were all non-detect were evaluated in the uncertainty assessment to determine if the detection limits were adequate for use in risk assessment.

The results of the beneficial mineral screen are summarized in Table 3-6. As seen, the maximum DI did not exceed the effective beneficial RBC for any mineral; thus, these four beneficial minerals were not selected as COPCs.

Section 4 provides an evaluation of exposure and risks from these exposure scenarios for all COPCs except lead, and Section 5 provides an assessment of exposure and risks from lead. Exposures from any metals not retained as COPCs are likely to be sufficiently small that they are not of concern.

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Section 4

Evaluating Chronic Exposure and Risk from Non-Lead COPCs

This section summarizes chronic exposure and risk to humans from non-lead COPCs in the mining districts. This section includes a description of the basic methods and data used to evaluate chronic exposure from non-lead chemicals, the estimated cancer and non-cancer risk levels related to these exposures, a discussion of the uncertainties in the evaluation, a review of background concentrations, and risk conclusions.

Risks from lead are evaluated using a different approach than for most other chemicals in that lead risks are determined based on estimated blood lead levels. The lead-specific approach for chronic exposure and risk evaluation is presented in Section 5.

4.1 Quantification of Chronic Exposure

4.1.1 Basic Equation

4.1.1.1 Ingestion Exposures

The amount of chemical which is ingested by receptors exposed to media may be quantified using the following general equation:

$$DI = C \cdot (IR / BW) \cdot (EF \cdot ED / AT) \cdot RBA$$

where:

DI = Daily intake of chemical (mg/kg of body weight/day).

C = Concentration of the chemical in the contaminated environmental medium to which the person is exposed. The units are mg/kg for soil/sediment (as dry weight), mg/L for water, and mg/kg (as wet weight) for fish and game tissues.

IR = Intake rate of the contaminated environmental medium. The units are kg/day for soil, L/day for water, kg/day (as wet weight) for fish and game.

BW = Body weight of the exposed person (kg).

EF = Exposure frequency (days/year). This describes how often a person is likely to be exposed to the contaminated medium over the course of a typical year.

ED = Exposure duration (years). This describes how long a person is likely to be exposed to the contaminated medium during their lifetime.

AT = Averaging time (days). This term specifies the length of time over which the average dose is calculated. For a chemical which causes non-cancer effects, the

averaging time is equal to the exposure duration. For a chemical that causes cancer effects, the averaging time is 70 years (25,550 days).

RBA = Relative bioavailability.

Note that the factors EF, ED, and AT combine to yield a factor between zero and one. Values near 1.0 indicate that exposure is nearly continuous over the specified averaging period, while values near zero indicate that exposure occurs only rarely.

For mathematical convenience, the general equation for calculating dose can be written as:

$$DI = C \cdot HIF \cdot RBA$$

where:

HIF = Human intake factor. This term describes the average amount of an environmental medium contacted by the exposed person each day.

The value of HIF is typically given by:

$$HIF = (IR / BW) \cdot (EF \cdot ED / AT)$$

The units of HIF are kg/kg-day (as dry weight) for soil/sediment, L/kg-day for water, and kg/kg-day (as wet weight) for fish and game tissues.

When the same individual may be exposed beginning as a child and extending into adulthood, exposure was calculated as the time-weighted average (TWA) lifetime exposure for evaluating non-cancer and cancer risks, as recommended in EPA guidance (EPA 1989). Lifetime exposure estimates for both cancer and non-cancer must account for differences in daily ingestion rates, body weights, and exposure durations for children and adults. For example, the ATV recreational rider population is assumed to include older children (ages 6–16 years old) and adults. This is accomplished by using factors for an older child for the first portion of the exposure duration and adult factors for the remaining years of the exposure period, as shown below:

$$TWA - DI = C \times \left[\frac{IR_c \times EF_c \times ED_c}{BW_c \times (AT_c + AT_a)} + \frac{IR_a \times EF_a \times ED_a}{BW_a \times (AT_c + AT_a)} \right]$$

where:

TWA-DI = Time-weighted average daily intake (mg/kg-day)

C = Chemical concentration (mg/L, mg/kg)

IR = Intake rate for an older child (IR_c) and an adult (IR_a) (mg/day, L/day)

EF = Exposure frequency for an older child (EF_c) and an adult (EF_a) (days/year)

ED = Exposure duration for an older child (ED_c) and an adult (ED_a) (years)

BW = Body weight for an older child (BW_c) and an adult (BW_a) (kg)

AT = Averaging time for an older child (AT_c) and an adult (AT_a) (days)

For the ATV guide and roadway worker, no time-weighted adjustment is necessary, as it is assumed the population is comprised of adults only (16+ years). For the ATV recreational rider, hiker, fisherman, and hunter, daily intakes are time-weighted (as described above) to account for exposures that begin as an older child and continue into adulthood. For the camper, daily intakes are time-weighted to include exposure as a child (less than [$<$] 6 years), older child (6–16 years), and an adult (greater than or equal to [\geq]16 years).

4.1.1.2 Inhalation Exposures

Inhalation exposures are evaluated in accordance with the inhalation dosimetry methodology presented in EPA's *Risk Assessment Guidance for Superfund (RAGS) Part F: Inhalation Risk Assessment* (EPA 2009a).

In accordance with EPA (2009a), the human intake equation does not include an inhalation rate or body weight because the amount of the chemical that reaches the target tissue is not a simple function of these factors. Therefore, the inhaled exposure concentration (EC) for chronic exposures is calculated as:

$$EC = C \cdot (ET \cdot EF \cdot ED / AT)$$

where:

EC = Exposure Concentration (micrograms [μg]/cubic meter [m^3]). This is the time-weighted concentration based on the characteristics of the exposure scenario being evaluated.

C = Concentration of the chemical in air ($\mu\text{g}/\text{m}^3$) to which the person is exposed.

ET = Exposure time (hours/day). This describes how long a person is likely to be exposed to the contaminated medium over the course of a typical day.

EF = Exposure frequency (days/year). This describes how often a person is likely to be exposed to the contaminated medium over the course of a typical year.

ED = Exposure duration (years). This describes how long a person is likely to be exposed to the contaminated medium during their lifetime.

AT = Averaging time (hours). This term specifies the length of time over which the time-weighted average concentration is calculated. The averaging time for non-cancer risk is equal to the exposure duration. The averaging time for cancer is 70 years (613,200 hours).

For mathematical convenience, the general equation for exposure concentration can be written as:

$$EC = C \cdot TWF$$

where:

TWF = Time-weighting factor (unitless). The value of TWF is given by:

$$TWF = (ET \cdot EF \cdot ED / AT)$$

As described above, when the same individual may be exposed beginning as a child and extending into adulthood (e.g., the camper), exposure was calculated as the TWA lifetime exposure.

4.1.2 Human Chronic Exposure Parameters

For every exposure pathway of potential concern, it is expected that there will be differences between different individuals in the level of exposure at a specific location because of differences in intake rates, body weights, exposure frequencies, and exposure durations. Thus, there is normally a wide range of average daily intakes between different members of an exposed population. Because of this, all daily intake calculations must specify what part of the range of doses is being estimated. Typically, attention is focused on intakes that are “average” or are otherwise near the central portion of the range, and on intakes that are near the upper end of the range (e.g., the 95th percentile). These two exposure estimates are referred to as Central Tendency Exposure (CTE) and Reasonable Maximum Exposure (RME), respectively.

Table 4-1 through Table 4-9 list the CTE and RME exposure parameters and resultant HIF values used in this assessment for recreational and occupational populations. Some of the values are informed by site-specific information, some are based on EPA default guidelines, and others are based on professional judgment or are estimated by extrapolation from other sites. The footnotes in the tables provide the basis and supporting rationale for each selected exposure parameter. Supplemental information for some exposure parameters is provided below.

ATV Guide (Area Use Factor) – Many guided ATV trips are conducted along the full Alpine Loop (i.e., from Silverton to Lake City); thus, portions of the guided trip are outside the Site. To account for the time spent by guides in areas beyond the Site, an assumed area use factor of 50% was used based on input provided by local guide services.

ATV Guide and ATV Recreational Rider (Riding Time) – Because it is not anticipated that the entire exposure time for the ATV guide and ATV recreational rider is spent riding an ATV (i.e., it is assumed a portion of the riding time may include stops), a riding time factor was incorporated into exposure calculations. An assumed ATV riding time factor of 75% was used for RME based on input from multiple local guide services. For CTE, the ATV riding time factor was assumed to be 50%.

ATV Recreational Rider (Exposure Time) – The exposure time for the RME ATV recreational rider was assumed to be less than the exposure time for the RME ATV guide (8 hours, based on a standard work day). A value of six hours was assumed for the RME ATV recreational rider.

Dispersed Camper (Exposure Frequency) – For the RME dispersed camper, the exposure frequency is based on the assumption the camper visits the Site the maximum allowable number of days specified in *Guidelines for the San Juan National Forest* (USFS 2017). As stated in these guidelines, campers are permitted to camp in a national forest for up to 14 days per month for 2 months. After they have been in the forest for 28 days, campers are to leave the national forest. The 28-day exposure frequency on national forest land is also protective of campers on BLM land in the mining districts, as the BLM has an annual limit of 14 days for dispersed camping. CTE exposure frequency was assumed to be one-half of the RME (i.e., 7 days per year).

USFS Camper (Exposure Frequency) – For the USFS camper, the RME exposure frequency is based on the maximum allowable days at the USFS campground (i.e., 14 days per year). CTE exposure frequency was assumed to be one-half of the RME (i.e., 7 days per year).

Child Camper (Ingestion Rate) – For the USFS camper and dispersed camper, the soil ingestion rate for RME and CTE is based on soil ingestion rates for campgrounds, as provided in the *Child-Specific Exposure Factors Handbook* (EPA 2008). For RME, the soil ingestion rate is based on the calculated⁹ 95th percentile of the data for all girls and boys (429 mg/day). For CTE, the soil ingestion rate is based on the mean of the reported geometric means for girls and boys (203 mg/day).

Recreational Fisherman (Incidental Ingestion Rate): Incidental ingestion from splashing or hand-to-face contact during wading assumed to be 10% of the EPA-recommended default incidentally ingested during swimming (EPA 1989). This ingestion rate is assumed to be representative of potential exposure to the fisherman. As noted previously, rafters or kayakers could also be exposed by incidental ingestion. However, exposure frequency is expected to be greater for the fisherman because more areas at the Site are suitable for fishing than rafting or kayaking, therefore these exposures have been conservatively represented by the fisherman.

Hunter (Ingestion Rate for Large Game) – For the RME hunter, the ingestion rate was assumed to be two meals per week, comprised of a half-pound (0.227 kg) serving of meat per meal. It was also conservatively assumed that 100% of the large game ingested by the hunter was harvested from within the mining districts. These assumptions consider that large game may be harvested throughout the archery season, muzzle season, and multiple rifle seasons and that game tissue may be available for consumption over extended periods.

Hunter (Ingestion Rate for Terrestrial Birds) – The bag limit for grouse at the Site (three grouse per day until nine are in possession, without a seasonal maximum) effectively results in an unlimited amount of birds that may be harvested. Therefore, bag limits could not be used to determine a Site-specific ingestion rate. For the RME hunter, the terrestrial bird ingestion rate was assumed to be 1 meal per 2 weeks, or one-half meal per week, comprised of a quarter-pound (0.114 kg) serving of meat per meal, or one-half the portion assumed for large game. It was also assumed that 100% of the terrestrial birds ingested were harvested from within the mining districts.

⁹ The 95th percentile was calculated from the reported geometric mean (GM) and geometric standard deviation (GSD).

4.1.3 Exposure Point Concentrations for Chronic Exposure

Based on the assumption of random exposure over an exposure area, risk from a chemical within an exposure area is related to the arithmetic mean concentration of that chemical averaged over the entire exposure area. Since the true arithmetic mean concentration cannot be calculated with certainty from a limited number of measurements, EPA recommends that the 95% upper confidence limit (95UCL) of the arithmetic mean for each exposure area be used as the exposure point concentration (EPC) when calculating exposure and risk at that location (EPA 1992).

The mathematical approach most appropriate for computing the 95UCL of a dataset depends on a number of factors, including the number of data points available, the shape of the distribution of the values, and the degree of censoring (EPA 2002b). Because of the complexity of this process, the EPA Technical Support Center has developed a software application called ProUCL v5.1.00 (EPA 2015c) to assist in the estimation of 95UCL values. ProUCL calculates 95UCLs for a dataset using several different strategies and recommends which 95UCL is considered preferable based on the properties of the dataset. In the calculation of the 95UCL, results ranked as non-detect are evaluated in ProUCL using regression on order statistics. It is recommended that a minimum of 8–10 samples be used when calculating the 95UCL. If the minimum detection frequency requirements for ProUCL are not met, the EPC is set equal to the maximum detected value. If ProUCL provides more than one recommended 95UCL to use; the higher value is used as the EPC. If the 95UCL exceeded the maximum concentration, the recommended 95UCL was selected, with the exception of cases where the recommended 95UCL was based on bootstrap-t. In these cases, the 95UCL based on the 99% Chebyshev inequality was selected per ProUCL guidance. The use of the Chebyshev inequality to compute upper confidence limits (UCLs) tends to yield more conservative (but stable) UCLs than other methods available in ProUCL software. The EPCs selected for use in the risk characterization are presented in Table 4-10. The ProUCL output for all COPCs used in exposure and risk calculations are presented in Appendix B.

4.1.3.1 Approach for Soil and Soil-Like Media

It is expected that hikers and hunters may be exposed to both waste rock and overbank soil. Therefore, the EPC values used in the risk calculations for these two receptors were weighted such that a portion of the exposure time was spent on overbank soil and the remainder of the time was spent on waste rock materials. The results of the “halo” sampling, which was conducted in the summer of 2017 for select mine locations within the Site, was used to inform the appropriate weighting proportions. As described in EPA (2017a), the halo area, or zone of influence for mine locations, was delineated to distinguish between areas of impacted soils and non-impacted soils using in situ X-ray fluorescence (XRF). XRF results were used to estimate a conservative halo acreage for mine locations that was then extrapolated to non-surveyed mine locations. Based on this sampling, it was estimated that approximately 2% of surficial soil material in the mining districts is comprised of mine-impacted soils (EPA 2017c). Because it is anticipated that mine waste may serve as an attraction to visitors, and that the time exposed to mine waste will not be directly related to the areal coverage of mine waste relative to overbank soil, it was assumed 10% of the hunter and hiker exposure occurs on waste rock materials and 90% occurs on overbank soils.

The time-weighted EPC was calculated as follows:

$$EPC_{\text{time-weighted}} = 0.9 \cdot EPC_{\text{overbank}} + 0.1 \cdot EPC_{\text{waste rock}}$$

As discussed in Section 2.8.1, only 10% (19 samples) of waste rock, campground, and roadway soils were sieved to 250 μm in size; therefore, samples sieved to 2 mm in size were used in the EPC calculations for non-lead COPCs. See Section 4.4.1.5 for a discussion of the potential uncertainty due to the use of this approach.

4.1.3.2 Approach for Surface Water, Sediments, Campsite Soils

Surface water samples were collected from many locations, including the main stream reaches, mine adits, and seeps and springs. Because it is more likely that fisherman will be exposed to surface water and sediment in the main stream reaches, samples were limited to those collected from locations in these areas for use in the calculation of the EPC values. Samples collected from adits, seeps, and springs were excluded from the EPC calculations.

For campers, surface water and sediment samples included in the calculation of the EPC were restricted to those collected from sampling locations within approximately one-quarter mile from the camping location in the main stream reaches (i.e., the USFS campground or dispersed campground).

For dispersed campsite soils, composite samples collected from dispersed campsites were grouped together for computation of the chronic EPC for campsite soil. This chronic EPC is representative of the long-term average concentration in soil to which dispersed campers may be exposed, based on the assumption campers may go to different campsites over several years. For campsites for which more than one sample was available (i.e., a sample was collected in 2016 and 2018), the sample collected in 2018 was used in preference to the 2016 sample because the location information for the 2018 sample is better documented and paired IVBA data are available.

For USFS campground soils, the EPC is based on the single composite soil sample collected from the USFS campground.

4.1.3.3 Approach for Airborne Dust during ATV Use

Recall there are two EUs for evaluating ATV exposures: the Alpine Loop portion within the Site (EU5a) and all unpaved roadways within the mining districts beyond the Alpine Loop (EU5b). For EU5a, ATV ABS data were collected from the entire portion of the Alpine Loop within the Site (Figure 2-11). These data represent the airborne particulate levels generated while ATV guiding. Samples were collected for the leading and following rider. Sample results for the following rider were elevated relative to the leading rider. Therefore, to be conservative in estimating exposure, the data for the following rider were used to compute the EPC. The average concentration for the follower was computed because the EPC is meant to be representative of a long-term average¹⁰.

¹⁰ The average concentration was computed due to the small sample size (five samples were collected for the following rider). The number of samples do not meet the minimum recommended sample number (i.e., 8–10 samples) recommended by ProUCL.

For EU5b, measured air data are not available for all roadways. In the absence of measured values for all roadways, the concentration of contaminants in air that would occur during ATV recreational riding was estimated using the following equation:

$$C(\text{air}) = C(\text{soil}) \cdot \text{PEF}$$

where:

$$C(\text{air}) = \text{concentration of contaminant in air } (\mu\text{g}/\text{m}^3)$$

$$C(\text{soil}) = \text{concentration of contaminant in soil } (\mu\text{g}/\text{kg})$$

$$\text{PEF} = \text{particulate emission factor (kg of soil per m}^3 \text{ of air)}$$

Appendix C presents the derivation of the Site-specific PEF for ATV recreational riding used in the risk assessment. The resulting PEF value is $5.6\text{E-}07 \text{ kg}/\text{m}^3$.

4.1.3.4 Approach for Airborne Dust from Roadways

Stationary air samples were collected along unpaved roads within the drainages to evaluate human health exposures and risks associated with inhaling road dust caused by passing ATVs and vehicles during the course of a work day for roadway workers. These direct measurements were used in the calculation of the EPC for metals in air.

4.1.3.5 Approach for Fish Ingestion

Samples of fillets from edible fish were used in calculation of the EPC values. Samples of subedible fish and forage fish were not used in EPC calculations. Fish tissue concentrations were reported by the laboratory as dry weight and converted to wet weight for use in EPC calculations using the sample-specific information on percent solids and the following equation:

$$\text{Concentration as wet weight} = \text{Concentration as dry weight} \cdot \text{percent solids} / 100$$

4.1.3.6 Approach for Game Ingestion

Although some people may ingest organ tissues, most individuals will prefer to ingest muscle tissues (e.g., backstrap for deer, breast for grouse). Therefore, samples collected from the muscle tissues were used in calculation of the EPC values for use in risk calculations. Organ tissue samples were used to compute an organ-specific EPC for use in discussing the uncertainty of only evaluating muscle tissue in the risk characterization. See Section 4.4 for a discussion of this uncertainty. Similar to fish tissue, game tissue results were reported by the laboratory as dry weight and converted to wet weight for use in EPC calculations using the same equation in Section 4.1.3.5.

4.1.4 Relative Bioavailability of Metals in Soil and Other Solid Media

An accurate assessment of human exposure to ingested chemicals requires knowledge of the amount of chemical absorbed from the gastrointestinal tract into the body from the site medium compared to the amount of absorption that occurred in the toxicity studies used to derive the toxicity factors. This ratio (amount absorbed from the site medium compared to the amount absorbed in toxicity tests) is referred to as relative bioavailability (RBA).

In general, metals in soil or soil-like media at mining sites exist in the form of mineral particles that are not rapidly solubilized in gastrointestinal fluids when ingested, while toxicity studies often utilize readily soluble forms of the test chemical. Thus, oral RBA values for metals in soil or soil-like media may be less than 1.0.

Conceptually, the most reliable method for obtaining site-specific estimates of RBA in soil or other solid media is to measure the gastrointestinal absorption in animals dosed with site soils compared to that for a fully soluble form of the metal. However, such *in vivo* tests are relatively costly and take considerable time to perform. No such animal data are available for any soil samples from the Site. One strategy to quantify bioavailability is to perform laboratory-based measurements of metal solubilization from soil samples. In this approach, a sample of soil or sediment is extracted using a fluid that has properties that resemble a gastrointestinal fluid, and the amount of metals solubilized from the sample into the fluid under a standard set of extraction conditions is measured. The amount of metal that is solubilized is referred to as the IVBA. The IVBA is then utilized to predict the *in vivo* RBA of the metal in that sample through an empiric correlation model that relates IVBA to *in vivo* RBA. To date, EPA has developed IVBA-to-RBA correlation models for arsenic (EPA 2017d) and lead (EPA 2007).

EPA conducted IVBA testing for arsenic and lead on 28 dispersed campsites, roadway, and waste rock samples collected from the mining districts. As shown in Table 4-10, IVBA values for arsenic ranged from 0–13%, suggesting the RBA of arsenic in these dispersed campsite, roadway, and waste rock materials is likely to be low. Arsenic RBA was predicted from the IVBA data using the regression model recommended in EPA (2017d) using the following equation (where the IVBA and RBA values are expressed as fractions, not percentages):

$$\text{RBA} = 0.79 \cdot \text{IVBA} + 0.03$$

It is not uncommon for mine waste and soils that are impacted by mining activities to have lower bioavailability because of the nature of the arsenic forms present in these materials. When media-specific arsenic RBA values were available (e.g., campsite soil, roadway soil, and waste rock), the average arsenic RBA for each medium was included in the risk calculations. For other solid media (i.e., overbank soils, sediment), the EPA default arsenic RBA of 0.60 was assumed (EPA 2012).

With the exception of lead (discussed in Section 5), RBA data are absent for other metals, so the RBA for all other non-lead metals was assumed to be 1.0. The RBA values employed in this risk assessment are likely to be conservative. See Section 4.4 for a discussion of the potential uncertainty due to RBA assumptions.

4.1.5 Chromium Valence State

In the environment, chromium may be present in various valence states, but the trivalent form, Cr(III), and hexavalent form, Cr(VI), are the most predominant, depending upon the nature of the contamination source and environmental conditions (Shahid et al. 2017). In the absence of a specific Cr(VI) source, chromium exists in the environment mainly as Cr(III) (Agency for Toxic Substances and Disease Registry [ATSDR] 2012; Han et al. 2004). Because the valence state of chromium is not known and data are available only for total chromium, risk calculations assumed the majority (90%) of the total chromium present in the collected environmental media samples was Cr(III) and the remainder (10%) was Cr(VI). This assumption is likely to be conservative

given there are no specific sources of Cr(VI) within the mining districts. See Section 4.4 for a discussion of the potential uncertainty due to the use of this approach.

4.2 Toxicity Assessment

4.2.1 Overview

The objective of a toxicity assessment is to identify the types of adverse health effects that are caused by a particular chemical, and how the appearance of these adverse effects depends on exposure level. In addition, the toxic effects of a chemical frequently depend on the route of exposure (oral, inhalation, dermal) and the duration of exposure. For the purposes of this HHRA, focus will be on long-term chronic exposures, recognizing that short-term exposures do occur (see Appendix F for a screening-level evaluation of acute exposures). Thus, a full description of the toxic effects of a chemical includes a listing of what adverse health effects the chemical may cause, and how the occurrence of these effects depends upon dose, route, and duration of exposure.

The toxicity assessment process is usually divided into two parts: the first characterizes and quantifies the non-cancer effects of the chemical, while the second addresses the cancer effects of the chemical. This two-part approach is employed because there are typically major differences in the time-course of action and the shape of the dose-response curve for cancer and non-cancer effects.

4.2.1.1 Non-Cancer Effects

Essentially all chemicals can cause adverse health effects at a sufficient dose. However, when the dose is sufficiently low, typically no adverse effect is observed. Thus, in characterizing the non-cancer effects of a chemical, the key parameter is the threshold dose at which an adverse effect first becomes evident. Doses below the threshold are considered to be safe, while doses above the threshold are likely to cause an effect.

The threshold dose is typically estimated from toxicological data (derived from studies of humans and/or animals) by finding the highest dose that does not produce an observable adverse effect, and the lowest dose which does produce an effect. These are referred to as the no-observed-adverse-effect level (NOAEL) and the lowest-observed-adverse-effect level (LOAEL), respectively. The threshold is presumed to lie in the interval between the NOAEL and the LOAEL. However, in order to be conservative (protective), non-cancer risk evaluations are not based directly on the threshold exposure level but on a value referred to as the reference dose (RfD) for oral exposures (e.g., incidental ingestion of soil, ingestion of drinking water, ingestion of dietary items), with units of mg per kg body weight per day (mg/kg-day), or the reference concentration (RfC), with units of mg/m³ for inhalation exposures. The RfD and RfC are estimates (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.

The RfD and RfC values are derived from the NOAEL, LOAEL, or benchmark dose by dividing by a UF that reflects the limitations of the data used. If the data are from studies in humans, and if the observations are considered to be very reliable, the UF may be as small as 1.0. However, the UF is normally at least 10, and can be much higher if the data are limited. UFs are assigned to account

for uncertainty arising from extrapolation of animal data to humans, the use of a LOAEL instead of a NOAEL, the use of less than chronic exposure, and other limitations in the available data (e.g., lack of reproductive data).

The effect of dividing the NOAEL or the LOAEL by a UF is to ensure that the RfD or RfC is not higher than the threshold level for adverse effects. Thus, there is always a “margin of safety” built into a RfD and RfC, and levels equal to or less than the RfD or RfC are nearly certain to be without any risk of adverse effect. Levels higher than the RfD or RfC may carry some risk, but because of the margin of safety, a level above the RfD or RfC does not mean that an effect will necessarily occur. The protectiveness of this margin of safety will vary from chemical to chemical, depending upon the quality of the data and the size of any applied UF. A chemical for which large UF has been applied will generally have a higher margin of safety than a chemical with a smaller UF.

4.2.1.2 Cancer Effects

For cancer effects, the toxicity assessment process has two components. The first is a qualitative evaluation of the weight of evidence (WOE) that the chemical does or does not cause cancer in humans. Previously, this evaluation was performed by EPA using the system summarized below:

WOE Group	Meaning	Description
A	Known human carcinogen	Sufficient evidence of cancer in humans.
B1	Probable human carcinogen	Suggestive evidence of cancer incidence in humans.
B2	Probable human carcinogen	Sufficient evidence of cancer in animals, but lack of data or insufficient data in humans.
C	Possible human carcinogen	Suggestive evidence of carcinogenicity in animals.
D	Cannot be evaluated	No evidence or inadequate evidence of cancer in animals or humans.
E	Not carcinogenic to humans	Strong evidence that it does not cause cancer in humans.

EPA has developed a revised classification system for characterizing the weight of evidence for carcinogens (EPA 2005a). However, this system has not yet been implemented for a number of chemicals, so the older classification scheme is retained for use in this assessment.

For chemicals which are classified in Group A, B1, B2, or C using EPA guidelines (EPA 1986), the second part of the toxicity assessment is to describe the carcinogenic potency of the chemical. This is done by quantifying how the number of cancers observed in exposed animals or humans increases as the dose increases. Typically, it is assumed that the dose-response curve for cancer has no threshold, arising from the origin and increasing linearly until high doses are reached. Thus, the most convenient descriptor of cancer potency is the slope of the dose-response curve at low doses (where the slope is still linear). This is referred to as the slope factor (SF), which has dimensions of risk of cancer per unit dose.

Estimating the cancer SF is often complicated by the fact that observable increases in cancer incidence usually occur only at relatively high doses, frequently in the part of the dose-response curve that is no longer linear. Thus, it is necessary to use mathematical models to extrapolate

from the observed high dose data to the desired (but unmeasurable) slope at low dose. In order to account for the uncertainty in this extrapolation process, EPA typically chooses to employ the 95UCL of the slope as the SF. That is, there is a 95% probability that the true cancer potency is lower than the value chosen for the SF. This approach ensures that there is a margin of safety in cancer risk estimates.

For inhalation exposures, cancer risk is characterized by an inhalation unit risk (IUR) value. This value represents the upper-bound excess lifetime cancer risk estimated to result from continuous lifetime exposure to a chemical at a concentration of 1 microgram per cubic meter ($\mu\text{g}/\text{m}^3$) in air.

4.2.2 Toxicity Values

Toxicity values (RfD, RfC, SF, and IUR values) established by EPA are listed in the Integrated Risk Information System (IRIS) (EPA 2018c). Other toxicity values are available as interim recommendations from EPA's Superfund Technical Assistance Center operated by the National Center for Environmental Assessment (NCEA). A toxicity value hierarchy was developed by EPA for use in site-specific risk assessments (EPA 2003a). This hierarchy provides an order of preference of toxicity values, with Tier 1 being the preferred source of toxicity information, if available, then Tier 2, followed by Tier 3. The recommended hierarchy of toxicity values is:

- Tier 1 – EPA's IRIS: IRIS assessments have undergone external peer review in accordance with EPA peer review guidance at the time of the assessment. IRIS health assessments contain EPA consensus toxicity values.
- Tier 2 – EPA's Provisional Peer Reviewed Toxicity Values (PPRTVs): The Office of Research and Development/NCEA/Superfund Health Risk Technical Support Center develops PPRTVs on a chemical-specific basis when requested by EPA's Superfund program.
- Tier 3 – Other Toxicity Values: Tier 3 includes additional EPA and non-EPA sources of toxicity information, such as the California Environmental Protection Agency and ATSDR. Priority should be given to those sources of information that are the most current, the basis for which is transparent and publicly available, and which have been peer-reviewed.

The EPA RSL tables include a summary of toxicity values derived from these sources using the tiered system described above. These tables are maintained by EPA and periodically updated (EPA 2018b). All toxicity values used in this assessment were taken from the most recent version of the RSL tables (November 2018), except as noted below. Table 4-12 shows the toxicity values used for evaluation of human health risks from COPCs. For metals with different values for different chemical forms, the values selected were based on the chemical form most similar to that expected to occur at the Site. Points to note regarding the data in this table include:

- Two oral RfD values are available for cadmium, depending on exposure medium (diet or water). The value for water is assumed to apply to surface water and groundwater, while the value for diet is assumed to apply to all other media (i.e., soil, sediment, fish and game tissue, and air).
- Two oral RfD values are available for manganese depending on exposure medium (diet or non-diet). The value for diet is assumed to apply to items in the diet (i.e., fish and game

tissue), while the value for non-diet is assumed to apply to all other media types (i.e., soil, sediment, air, and water). The non-diet RfD for manganese (4.7E-02 mg/kg-day) is based on the oral RfD of 1.4E-01 mg/kg-day in the diet. In accordance with recommendations in IRIS (EPA 2018c), for application to non-diet exposures, the RfD was adjusted by dividing by a modifying factor of 3.

Qualitative information for non-carcinogens is also provided in Table 4-12 in the form of target tissues for chronic exposures. Target tissues are important for the evaluation of combined non-cancer exposures to multiple chemicals (see Section 4.3.1).

4.3 Risk Characterization

4.3.1 Basic Approach

The following subsections provide the basic approach for characterizing for non-cancer hazards and cancer risks for chronic exposures.

4.3.1.1 Non-cancer effects

The potential for non-cancer effects from a COPC is evaluated by comparing the estimated site-related exposure for a receptor over a specified time-period to the RfD or RfC for that COPC. This ratio of site-related exposure to the safe exposure level is called the HQ. If an individual is exposed to more than one chemical, a screening-level estimate of the total non-cancer hazard is derived simply by summing the HQ values across individual chemicals and exposure pathways. This total is referred to as the hazard index (HI). If the HI value is less than or equal to $[\leq] 1$, non-cancer hazards are not expected from any chemical, alone or in combination with others. If the screening level HI exceeds 1, it may be appropriate to perform a follow-on evaluation in which HQ values are added only across chemicals that affect the same target tissue or organ system (e.g., the liver). This is because chemicals that do not cause toxicity in the same tissues are not likely to cause additive effects.

Hazards from Ingestion

The potential for non-cancer effects from ingestion is evaluated by comparing the estimated daily intake of the chemical over a specific time period with the RfD for that chemical derived for a similar exposure period, as follows (EPA 1989):

$$HQ = DI / RfD$$

where:

DI = Daily Intake (mg/kg-day)

RfD = Reference Dose (mg/kg-day)

Hazards from Inhalation

For inhalation exposures, the potential for non-cancer effects is evaluated by comparing the time-weighted EC over a specific time-period to the RfC for that chemical, as follows (EPA 1994a):

$$HQ = EC / RfC$$

where:

EC = Exposure Concentration (mg/m³)

RfC = Inhalation Reference Concentration (mg/m³)

4.3.1.2 Cancer effects

The excess risk of cancer from exposure to a chemical is described in terms of the probability that an exposed individual will develop cancer because of that exposure. Excess cancer risks are summed across all carcinogenic chemicals and all exposure pathways that contribute to exposure of an individual in a given population. The level of total cancer risk that is of concern is a matter of personal, community, and regulatory judgment. In general, EPA considers excess cancer risks that are below 1E-06 to be so small as to be negligible, and risks above 1E-04 to be sufficiently large that some sort of remediation is desirable¹¹. Excess cancer risks that range between 1E-04 and 1E-06 are generally considered to be acceptable (EPA 1991b), although this is evaluated on a case-by-case basis, and EPA may determine that risks lower than 1E-04 are not sufficiently protective and warrant remedial action. Cancer risks for each chemical are calculated as described below.

Risks from Ingestion

The excess risk of cancer from exposure to a chemical is described in terms of the probability that an exposed individual will develop cancer because of that exposure. The excess risk of cancer from ingestion exposure to a chemical is calculated as follows (EPA 1989):

$$\text{Excess Cancer Risk} = 1 - \exp(-DI_L \cdot SF)$$

where:

DI_L = Daily intake, averaged over a lifetime (mg/kg-day)

SF = Slope Factor (mg/kg-day)⁻¹

In most cases (except when the product of DI_L · SF is larger than about 0.01), this equation may be approximated by the following:

$$\text{Excess Cancer Risk} = DI_L \cdot SF$$

Risks from Inhalation

The excess risk of cancer from inhalation exposure to a chemical is calculated based on IUR values, as follows (EPA 2009a):

$$\text{Excess Cancer Risk} = EC \cdot IUR$$

¹¹ Excess cancer risk can be expressed in several formats. A cancer risk expressed in a scientific notation format as 1E-06 is equivalent to 1 in 1,000,000 or 10⁻⁶. Similarly, a cancer risk of 1E-04 is equivalent to 1 in 10,000 or 10⁻⁴. For the purposes of this document, all cancer risks are presented in a scientific notation format.

where:

EC = Exposure Concentration ($\mu\text{g}/\text{m}^3$)

IUR = Inhalation Unit Risk ($\mu\text{g}/\text{m}^3$)⁻¹

Mutagenic Modes of Action

For chemicals identified as having a mutagenic mode of action for carcinogenesis, cancer risks were estimated in accordance with the *Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens* (EPA 2005b). As shown in Table 4-12, the only COPC with a mutagenic mode of action is Cr(VI). When evaluating exposures to Cr(VI), the default age-dependent adjustment factors (ADAFs) were applied to the cancer slope factor to account for differences in potency that may occur from exposure during early life (up to age 16), as follows:

- 0 to <2 years: ADAF = 10
- 2 to <16 years: ADAF = 3
- ≥ 16 years: ADAF = 1 (i.e., no adjustment necessary)

EPA (2005b) further indicates that any grouping of ages in the exposure assessment will need to be integrated with the ADAF age groupings to derive age group-specific risk estimates. For each age interval ‘i’, the cancer risk for exposure by a specified pathway is computed as:

$$\text{Risk}_i = C \cdot (\text{HIF} \cdot \text{ED}_i / \text{ED}_{\text{total}}) \cdot \text{SF} \cdot \text{ADAF}_i$$

where:

Risk_i = Excess cancer risk for age interval “i”

C = concentration of chemical in the exposure medium (e.g., mg/kg for soil)

HIF = human intake factor for the exposure medium (e.g., kg/kg-day for soil)

ED_i = exposure duration for age interval “i” (years)

ED_{total} = total exposure duration (years)

SF = cancer slope factor (mg/kg-day)⁻¹

ADAF_i = Age-dependent adjustment factor for age interval “i” (unitless)

Total risk to the individual is the sum of the risks across all age intervals:

$$\text{Total Risk} = \text{Risk}_{0-2} + \text{Risk}_{6-16} + \text{Risk}_{16+}$$

As seen in the equation above, the HIF term is time-weighted ($\text{ED}_i / \text{ED}_{\text{total}}$) to be specific to the age interval “i”. For the receptors of interest, the following time-weighting factors were applied to each age interval when quantifying exposures from Cr(VI).

Age Group	Age Interval	ADAF (unitless)	ATV Guide, Road Worker	Hiker, Fisherman, Hunter	Camper
Child	1 [0–<2 years]	10	---	---	CTE: 1.00, RME: 0.33
	2 [2–<6 years]	3	---	---	CTE: 0, RME: 0.67
Older Child	3 [6–<16 years]	3	---	0.50	0.50
Adult	4 [16 years]	1	1.00	0.50	0.50

--- = this age group is not applicable to this receptor

For example, for the RME camper at the USFS campground (see Tables 4-5 and 4-7), the total exposure duration is 26 years (6 years as a child, 10 years as an older child, and 10 years as an adult). For the purposes of the ADAF time-weighting adjustment, this exposure is allocated as 2 years in age interval 1, 4 years in age interval 2, 10 years in age interval 3, and 10 years in age interval 4. An example calculation for the ADAF-adjustment for incidental soil ingestion is shown in the following inset:

CALCULATION EXAMPLE OF ADAF-ADJUSTMENT:

$$\begin{aligned} \text{Excess Cancer Risk} = & [\text{Csoil} \cdot (\text{HIFsoil, child} \cdot \text{ED}_{0-<2\text{yrs}} / \text{ED}_{\text{child}}) \cdot \text{SF} \cdot \text{ADAF}_{0-<2\text{yrs}}] + \\ & [\text{Csoil} \cdot (\text{HIFsoil, child} \cdot \text{ED}_{2-<6\text{yrs}} / \text{ED}_{\text{child}}) \cdot \text{SF} \cdot \text{ADAF}_{2-<6\text{yrs}}] + \\ & [\text{Csoil} \cdot (\text{HIFsoil, adult} \cdot \text{ED}_{6-<16\text{yrs}} / \text{ED}_{\text{adult}}) \cdot \text{SF} \cdot \text{ADAF}_{6-<16\text{yrs}}] + \\ & [\text{Csoil} \cdot (\text{HIFsoil, adult} \cdot \text{ED}_{16+\text{yrs}} / \text{ED}_{\text{adult}}) \cdot \text{SF} \cdot \text{ADAF}_{16+\text{yrs}}] \end{aligned}$$

When the receptor-specific exposure parameter values are substituted, the equation becomes:

$$\begin{aligned} \text{Excess Cancer Risk} = & [\text{Csoil} \cdot (9.40\text{E-}08 \text{ kg/kg-d} \cdot 2 \text{ yrs} / 6 \text{ yrs}) \cdot \text{SF} \cdot 10] + \\ & [\text{Csoil} \cdot (9.40\text{E-}08 \text{ kg/kg-d} \cdot 4 \text{ yrs} / 6 \text{ yrs}) \cdot \text{SF} \cdot 3] + \\ & [\text{Csoil} \cdot (3.86\text{E-}08 \text{ kg/kg-d} \cdot 10 \text{ yrs} / 20 \text{ yrs}) \cdot \text{SF} \cdot 3] + \\ & [\text{Csoil} \cdot (3.86\text{E-}08 \text{ kg/kg-d} \cdot 10 \text{ yrs} / 20 \text{ yrs}) \cdot \text{SF} \cdot 1] \end{aligned}$$

Risks associated with inhalation exposure to carcinogens that act via a mutagenic mode of action are calculated in similar fashion by applying the appropriate ADAF(s) along with the corresponding IUR, using pertinent estimates of exposure concentration.

4.3.2 Results

Detailed calculations of chronic exposure and risk from non-lead COPCs for each exposure scenario are provided in Appendix D for both the CTE and RME scenarios. Non-cancer HIs and total cancer risks (across chemicals) based on RME scenarios are summarized in Table 4-13. As seen, all risk estimates are within EPA's acceptable risk guidelines (i.e., HI values ≤ 1 and cancer risk values $< 1\text{E-}04$). The following sections present the main conclusions for RME scenarios.

4.3.2.1 ATV Guide and ATV Recreational Rider

Risks were evaluated for ATV guides while traveling the Alpine Loop (EU5a; Appendix D-1) and ATV recreational riders while traveling all roadways at the Site (EU5b; Appendix D-2). Exposures were quantified for inhalation of particulates caused by human disturbance (i.e., ATV recreational

riding) and incidental ingestion of roadway soil. RME non-cancer HIs are ≤ 1 and cancer risks are $< 1E-04$ for both the ATV guide and the ATV recreational rider.

4.3.2.2 Hiker

Risks were evaluated for hikers while hiking along drainages in EU1 (Animas River upstream of the south fork), EU2 (Animas River downstream of the south fork), EU3 (Cement Creek), and EU4 (Mineral Creek) (see Appendix D-3 through Appendix D-6, respectively). Exposures were quantified for incidental ingestion of a mixture of overbank soil and waste rock. RME non-cancer HIs are < 1 and cancer risks are $< 1E-04$ for all exposure units.

4.3.2.3 Camper (USFS Campground)

Risks were evaluated for campers at the USFS campground (EU6; Appendix D-7). Exposures were quantified for incidental ingestion of surface water, ingestion of groundwater (as drinking water), and incidental ingestion of sediment and soil. RME non-cancer HIs are < 1 and cancer risks are $< 1E-04$.

4.3.2.4 Camper (Dispersed Locations)

Risks were evaluated for campers in dispersed camping locations (EU7; Appendix D-8). Exposures were quantified for ingestion of surface water (as drinking water) and incidental ingestion of surface water, sediment, and campsite soil. RME non-cancer HIs are ≤ 1 and cancer risks are $< 1E-04$.

4.3.2.5 Fisherman

Risks were evaluated for fishermen who fish in Mineral Creek (EU8; Appendix D-9) and the lower portion of the Animas River (EU9; Appendix D-10). Exposures were quantified for incidental ingestion of surface water and sediment and ingestion of fish. RME non-cancer HIs are < 1 and cancer risks are $< 1E-04$ for both exposure units.

4.3.2.6 Hunter

Risks were evaluated for hunters while hunting along drainages in EU1 (Animas River upstream of the south fork), EU2 (Animas River downstream of the south fork), EU3 (Cement Creek), and EU4 (Mineral Creek) (see Appendix D-11 to D-14, respectively). Exposures were quantified for ingestion of game (grouse and deer) and incidental ingestion of overbank soil/waste rock. RME non-cancer HIs are less than 1 and cancer risks are less than $1E-04$ for all exposure units.

4.3.2.7 Road Worker

Risks were evaluated for road workers while working along drainages in EU1 (Animas River upstream of the south fork), EU2 (Animas River downstream of the south fork), EU3 (Cement Creek), and EU4 (Mineral Creek) (see Appendix D-15 to D-18, respectively). Exposures were quantified for inhalation of particulates caused by roadway soil disturbances and incidental ingestion of roadway soil. RME non-cancer HIs are ≤ 1 and cancer risks are $< 1E-04$ for all exposure units.

4.4 Uncertainty Assessment

Quantitative evaluation of the risks to humans from environmental contamination is frequently limited by uncertainty regarding a number of key data items, including concentration levels in the environment, the true level of human contact with contaminated media, and the true dose-response curves for non-cancer and cancer effects in humans. This uncertainty is usually addressed by making assumptions or estimates for uncertain parameters based on whatever limited data are available. Because of these assumptions and estimates, the results of risk calculations are themselves uncertain, and it is important for risk managers and the public to keep this in mind when interpreting the results of a risk assessment. The following sections review the main sources of uncertainty in the chronic risk calculations for non-lead COPCs.

4.4.1 Uncertainties in Exposure Assessment

4.4.1.1 Uncertainties from Exposure Pathways Not Evaluated

As discussed above, humans may be exposed to chemicals by a number of pathways, but not all of these pathways were evaluated quantitatively in this risk assessment. In most cases, this is because the contribution of the pathway omitted is believed to be minor compared to one or more other pathways that were evaluated. For example, dermal exposure to metals in soil, sediment, and water were not quantified. Omission of these minor pathways will result in a small underestimation of exposure and risk, but the magnitude of this underestimation is not expected to be significant.

As seen in Figure 3-1, some pathways were not evaluated quantitatively for all receptors, recognizing that the pathways were to be evaluated for more sensitive receptors (because of greater exposure frequencies, incidental ingestion rates, exposure time, etc.). These pathways were denoted with an “X” and footnote number 6 in the CSM (Figure 3-1). In brief, incidental ingestion of surface water and sediment was not evaluated quantitatively for hikers and hunters because these pathways were evaluated for campers. Table 4-14 presents a comparison of exposure input parameters for the camper (adult in dispersed camping locations) versus the hiker and hunter. As seen, the ratio of the HIF values reveals that exposure rates for the hunter from incidental ingestion of surface water and sediment are 20% lower than the exposure rates for the camper. The exposure rates for the hiker from incidental ingestion of surface water and sediment are 60% lower than the exposure rates for the camper. Because non-cancer and cancer risks are below the target thresholds for these pathways for the dispersed camper (see Table 4-13; RME HI for from incidental ingestion surface water and sediment is 0.1, cancer risk from incidental ingestion surface water and sediment is $1E-07$), it is expected that non-cancer and cancer risks for these pathways for the hunter and hiker would contribute very minimally to the cumulative risk for these receptors.

4.4.1.2 Uncertainties from Chemicals Not Evaluated

As discussed above, quantitative risk estimates are derived only for COPCs. Chemicals that were detected in Site samples but excluded as COPCs may contribute a small amount of added risk. However, the contribution is expected to be so small that this is not a source of significant uncertainty. It is noted that some analytes were not evaluated because they were not measured in media for some samples. For roadway air samples, antimony, cadmium, cobalt, iron, thallium, and zinc were not analyzed. For ATV ABS air samples, antimony, cobalt, and thallium were not

analyzed. For surface water samples collected near the USFS campground, cobalt, molybdenum, potassium, thallium, and vanadium were not analyzed. In the absence of data, no conclusions can be drawn regarding the potential for risk from these analytes.

4.4.1.3 Uncertainties in Exposure Point Concentrations

In all exposure calculations, the desired input parameter is the true mean concentration of a contaminant within a medium, averaged over the area where random exposure occurs. However, because the true mean cannot be calculated based on a limited set of measurements, EPA (1989, 1992) recommends that the exposure estimate be based on the 95UCL. When data are plentiful and inter-sample variability is not large, the UCL may be only slightly higher than the mean of the data. However, when data are sparse or are highly variable, the 95UCL may be substantially greater than the mean of the available data. Thus, use of the UCL is expected to result in a conservative estimate of risk in most cases. As seen in Appendix D, even where the 95UCL exceeds the maximum concentration (denoted with footnote C in the tables), estimated non-cancer HIs are ≤ 1 and cancer risks are $< 1E-04$.

Measured air concentrations were not available for ATV recreational riders that ride on unpaved roads outside the Alpine Loop (i.e., in EU5b). Air samples were only collected to represent exposures for road workers and ATV guides riding within the Alpine Loop (i.e., in EU5a). Therefore, when quantifying dust inhalation exposures for ATV recreational riders, airborne concentrations were estimated using a screening-level soil-to-air PEF. In general, such predicted concentration values have high uncertainty compared to measured values, so the actual concentrations of metals in airborne dust are uncertain, and true values might be either higher or lower than calculated. In order to be conservative, measured air data during ATV ABS for the following (versus leading) rider were used in the PEF calculations. Because manganese was detected in each ATV ABS air sample, manganese air and soil concentrations were used as the basis of the PEF, which was applied to all COPCs. It is not expected there are chemical-specific differences in soil-to-air releases.

The soil EPC for the hiker and hunter is weighted based on an assumed fraction of time spent exposed to overbank soil (90%) and to waste rock (10%). This weighting approach is based on professional judgement, recognizing that hikers and hunters will encounter waste materials in the mining districts for only a small portion of the time. Because this weighting approach was based on professional judgement, the true values might be either higher or lower than estimated.

The EPC for game tissue (deer and grouse) was limited to muscle tissue. It is possible that a hunter may ingest the organs of game animals and organ tissues may have higher concentrations of metals present depending on the chemical. However, the frequency that organs collected from the Site may be ingested compared to muscle tissue from the Site is expected to be significantly less. Because ingestion of organ tissues was not included in this evaluation, a small underestimation of exposure and risk is possible, but the magnitude of this underestimation is not expected to be significant.

4.4.1.4 Uncertainties in Data Adequacy

An evaluation of data adequacy is performed in two steps. The first step is to determine if the data are representative in space and time. This is usually a qualitative assessment. The second step is

to determine if the data are statistically adequate. For data to be used for evaluation of risks to humans, statistical adequacy considers the magnitude of the uncertainty in the measured average exposure concentration, the proximity of the exposure concentration to a decision threshold, and whether the uncertainty is too large to support confident decision-making.

Spatial and Temporal Representativeness

Surface Soil/Mine Waste

A variety of soil/mine waste types have been sampled, including overbank soil, floodplain, waste rock, roadway, campground, and upland reference soil, as described in Section 2.8.1. Samples were collected using a composite approach, which means the reported concentration for a sample is representative of the average within a larger sampling area. Because the average (mean) concentration is the statistic of interest for the purposes of risk assessment, use of a composite sampling methodology provides a better estimate of exposures compared to a discrete (grab) sampling methodology.

Mine waste materials were deposited and soils became contaminated several decades ago when mining activities were actively occurring at the Site. While the valence state and chemical form of metals may change based on environmental conditions, total concentrations in surface soil/mine waste are not expected to vary over time. Samples collected from 2015–2018 are likely to be representative of both current and future exposure conditions.

Samples of mine waste have been collected from each of the 48 mines included in the NPL listing. Roadway soil samples have been collected from each of the roadways along the major drainages and from many of the subdrainages, with a greater sample density near the mine locations. Campground soil samples have been collected from the USFS campground and 14 dispersed campsite locations. While there are dispersed camping locations that have not been characterized, the locations that have been characterized are those that are anticipated to be used most frequently and are likely to be representative of unsampled locations. The upland reference soil samples were collected from a variety of locations in areas that did not appear to be impacted by Site activities. Therefore, it is concluded the surface soil/mine waste data are spatially and temporally representative, and these media have been adequately characterized for use in this HHRA.

Sediment/Surface Water

Multiple surface water sampling events have been conducted from 2015–2018. Samples have been collected throughout each of the three main drainages (Mineral Creek, Cement Creek, and the Animas River) and all subdrainages, as described in Section 2.8.2 and Section 2.8.3. Samples have been collected upstream and downstream of surface water inputs with the potential to influence in-stream surface water and sediment concentrations. Although the available sediment and surface water data are representative of the Site drainages and subdrainages, there are no Site-specific data available from background locations to provide information on metal concentrations in areas that are unimpacted by Site activities.

As discussed in Section 2.3, in summer 2015, there was an uncontrolled release of mining-impacted water to the Animas River. Because the purpose of the HHRA is to evaluate exposures under current and future conditions, only samples collected from 2015–2018 were included in the risk characterization to ensure the data were representative of post-spill conditions.

Metals concentrations have the potential to vary temporally in surface water, both in the short term (diurnally) and long term (seasonally within a year and from year to year). Human exposures to sediment/surface water are most likely to occur during the summer months (between Memorial Day and Labor Day). In general, sediment/surface water samples have been collected in spring (during high-flow conditions) and in fall (during low-flow conditions).

As described above, available sediment and surface water data from the Site are spatially and temporally representative, therefore, these media have been adequately characterized for use in this HHRA.

Groundwater

Access to groundwater is generally limited to the USFS campground. Groundwater samples have been collected from the campground well. Therefore, the spatial representativeness for groundwater is adequate. However, there are only two grab samples (one in August 2010 and one in June 2017), thus, the available groundwater data only represent these two limited time intervals. Even so, both samples were collected during the summer months, when human exposures are most likely to occur at the USFS campground. The temporal representativeness of the groundwater dataset could be improved, however, the need for this may depend on the statistical adequacy of the analytical results. Because the risk characterization did not indicate measured groundwater concentrations for the campground well resulted in unacceptable exposures, the data have been deemed adequate for use in performing screening-level exposure estimates in this HHRA.

Dietary Items (Game and Fish Tissue)

There are a variety of animals that may be harvested from the Site by hunters and fishermen for consumption. Game tissue samples were collected for deer and grouse, which are two species that are likely to be most commonly hunted at the Site. Although game tissues were only collected from in the Mineral Creek drainage, because deer and grouse have relatively large home range sizes, they may forage across the Site; thus, contamination levels in their tissues represent a composite of multiple areas within the Site. While there were only a few animals that were harvested (two deer and three grouse), it is expected the collected samples are representative of other game animals present at within the mining districts.

Fish tissue samples were collected from each of the main drainages and subdrainages where fish were present. While it is expected that contamination levels in fish tissues vary by species and size (larger, older fish tend to have higher tissue levels than smaller, younger fish), the fish samples were collected for a species (brook trout) and size most likely to be kept for consumption by fishermen.

As described above, while the tissue dataset is limited, the collected samples are representative of the types of tissues that may be ingested by humans and are adequate for use in this HHRA.

Air

Because stationary roadway air samples have been collected from the main unpaved roads within each of the main drainages at the Site, the spatial representativeness of these samples is deemed adequate for use in this HHRA. The roadway air samples were collected during fall 2017, during a time when roadway use was moderately high. While these samples were not collected during peak activity on the roadways at the Site (July through August), it is reasonable to expect that these samples are representative of average roadway air conditions spanning the spring to fall months when there is no snow on the ground.

ATV ABS air samples were collected throughout the Alpine Loop (EU5a) and are representative of the inhalation exposures for the ATV guide. The ATV ABS air samples were collected following a relatively dry summer for the mining districts and are therefore representative of the high-end of air concentrations that could be experienced.

There are no measured data on air concentrations during ATV recreational riding on unpaved roadways outside the Alpine Loop (EU5b). Therefore, inhalation exposures for the ATV recreational riders were evaluated using estimated air concentrations derived from Site roadway soil concentrations as detailed in Section 4.1.3.3. As noted above, concentrations in surface soil are not expected to vary over time and the available roadway soil dataset is representative of the roads where ATV recreational riding is most likely to occur. Therefore, the roadway soil used to estimate air concentration while riding ATVs in EU5b has been adequately characterized for use in this HHRA.

Detection Limit Adequacy

Detection limit adequacy is determined by performing an evaluation of the achieved laboratory detection limits for each chemical in each media in cases where the samples were all non-detect to determine if the achieved detection limits were low enough to support risk management decision-making. This detection limit adequacy evaluation is presented in Section 4.4.1.3 for non-lead chemicals and discussed in detail below.

During the COPC selection process, several analytes were non-detect in Site media based on the Site-wide dataset. For surface water, all analytical results for mercury were non-detect. As shown in Table 3-3, the mean of the method detection limits (MDLs) was less than the residential tap water RSL, which indicates the achieved MDLs were adequate to support the HHRA.

For groundwater samples collected at the USFS campground, all analytical results for aluminum, antimony, arsenic, beryllium, cadmium, iron, manganese, and selenium were non-detect. As shown in Table 3-4, with the exception of arsenic, the mean of the MDLs was less than the residential tap water RSL for all analytes. Because the tap water RSL is intended to be protective of residential exposure, it is likely to be overly conservative for a camper exposure scenario. Therefore, risk calculations for the child camper at the USFS campground (the most sensitive receptor) were performed using one-half the average MDL as the EPC to determine if the

achieved arsenic MDL for groundwater was adequate for the types of receptors expected at the Site. The results of this evaluation are shown in Table 4-15 and reveal an HQ value for arsenic of 0.2 and cancer risk at $3E-05$, both are which are within EPA's acceptable risk range. Based on this, it is likely that arsenic in groundwater at the USFS campground is not significantly contributing to risk at the Site.

In some instances, analytical results for some COPCs were all non-detect for certain EUs. In order to determine if the MDLs were adequate to support risk management decisions at the Site, risk calculations were performed using one-half the average MDL as the EPC for the most sensitive receptor in the EU. Table 4-16 presents this detection limit adequacy evaluation. As seen, with three exceptions, risks computed using one-half the MDL as the EPC are all within EPA's acceptable risk range.

- Arsenic, cadmium, and chromium in ATV ABS air (ATV guide) – For ATV ABS air, analytical results were non-detect for several metals. Risk calculations for the ATV guide were performed using one-half the average MDL as the EPC to determine if the MDL was adequate for ATV ABS air. As seen in Table 4-16 (Panel A), the results of this evaluation reveal HQ values ≤ 1 and cancer risk $< 1E-04$. This demonstrates that the MDLs achieved during the analysis of the ATV ABS air samples were adequate to determine if COPCs may be present at unacceptable exposure levels. Because the non-cancer HQ for arsenic based on one-half the average MDL was equal to 1, an alternative evaluation of arsenic was performed by estimating the potential air concentration during ATV use from measured roadway soil concentrations using the Site-specific PEF (as developed in Appendix C). The resulting arsenic HQ using the predicted air concentration was 0.02. This alternative evaluation provides another line of evidence to demonstrate that arsenic concentrations in air due to ATV use are not significantly contributing to risks at the Site.
- Thallium in deer tissue (Hunter) – Although thallium was not detected in deer tissues, when risk calculations were performed using one-half the average MDL as the EPC (see Table 4-16, Panel H), the non-cancer HQ due to ingestion of thallium in deer tissue for the hunter was greater than 1 (HQ value of 7). This shows the MDL achieved during the analysis of thallium in deer tissue (using the best laboratory practices and analytical methods) was too high to determine if it may be present at unacceptable exposure levels. Although this is a source of uncertainty and might lead to an underestimate of risk, it is important to note that there is little reason to suppose thallium is actually present in Site media at levels of concern because of historical mining activities. A comparison of the 95UCL on the mean for upland reference soil (1.1 mg/kg) versus Site soil EPCs for each EU (see Appendix Tables D-11a through D-14a) reveals that Site soil concentrations are less than upland reference soil. This suggests thallium levels in environmental media at the Site, including deer tissues, are likely to be representative of local reference conditions. Consequently, the inadequate detection limit for thallium in deer tissue is not likely to be a significant limitation.
- Arsenic in roadway air (Road Worker) – For arsenic in roadway air, all analytical results were non-detect. Risk calculations for the roadway worker were performed using one-half the average MDL as the EPC to determine if the MDL was adequate for roadway air. As seen

in Table 4-16 (Panel I), the results of this evaluation reveal a HQ value for arsenic of 30 and cancer risk at $3E-04$, both are which are above EPA's acceptable risk range. This shows the MDL achieved during the analysis of arsenic in roadway air samples was too high to determine if it may be present at an unacceptable exposure level. The potential issue with inadequate MDLs was recognized at the time of the development of the governing sampling and analysis plan for the roadway air sampling (EPA 2017a). Air samples were collected using the best available sampling techniques and analytical methods.

Because the non-cancer HQ for arsenic based on one-half the average MDL was greater than 1, and the cancer risk was greater than $1E-04$, an alternative evaluation of arsenic was performed by estimating the potential air concentration using measured roadway soil concentration. Although there are default PEF equations provided in the literature to estimate air concentrations for a construction worker exposure scenario, use of these equations requires many assumptions about the dust emission sources (e.g., vehicle size, vehicle distance traveled, frequency of days without rainfall). There are Site-specific measurements of dust emissions during ATV use, which is more representative of the types of vehicles roadway workers would likely encounter along Site roadways. Therefore, the Site-specific PEF for ATV guides was used (as developed in Appendix C) to estimate potential air concentrations for roadway workers. Recall that this Site-specific PEF was derived using only data collected from the following rider, thus, this is likely to be a conservative estimate of airborne exposures for a roadway worker. Risk estimates are based on the arsenic EPC for soil in EU1, where the highest EPC was calculated for the roadway worker. The resulting arsenic HQ using the predicted air concentration was 0.3 and the cancer risk was $2E-06$. This alternative evaluation provides another line of evidence to demonstrate that arsenic concentrations in air are not significantly contributing to risks at the Site.

4.4.1.5 Uncertainty in the Soil Particle Size Fraction

The soil particle size fraction selected for use in EPC calculations was the bulk fraction (i.e., passing a 2-mm sieve), recognizing that only 10% of samples were sieved to $250\ \mu\text{m}$. As shown in Table 4-17, the average ratio of the bulk concentration to the $250\text{-}\mu\text{m}$ concentration across all soil types and all metals was about 0.90, which indicates the results for the two size fractions are generally similar. Use of the bulk fraction in the EPC calculations has the potential to slightly underestimate the exposure concentration, but the difference in concentration does not alter risk conclusions. When increasing risk estimates by 10%, RME non-cancer HIs are ≤ 1 and cancer risks are $< 1E-04$ for all receptors (detailed calculations not shown). Note, this ratio is based on a comparison of 10% of the samples, so the actual value may be higher or lower if data were available for a larger fraction of the samples.

4.4.1.6 Uncertainties in Human Exposure Parameters

Accurate calculation of risk values requires accurate estimates of the level of human exposure that is occurring. However, many of the required exposure parameters are not known with certainty and must be estimated from limited data or knowledge. Likewise, data are absent on the amount of actual amount of environmental medium ingested by recreational visitors and workers, and the values used in the calculations are based mainly on professional judgment. In general, when exposure data were limited or absent, the exposure parameters were chosen in a

way that was intended to be conservative. Because of this, the values selected are more likely to overestimate than underestimate actual exposure and risk.

4.4.1.7 Uncertainties in Chemical Absorption (RBA)

The risk from an ingested chemical depends on how much of the ingested chemical is absorbed from the gastrointestinal tract into the body. Understanding bioavailability is especially important for metals in soil and soil-like materials at mining sites, because some of the metals may exist in poorly absorbable forms, and failure to account for this may result in a substantial overestimation of exposure and risk. In the absence of data, the default approach is to assume that the RBA is 1.0 for most metals. Use of this default assumption is likely to overestimate the true risk with the magnitude of the error depending on the true RBA value.

For arsenic, data from the IVBA analysis suggest that Site-specific RBA is likely to be no higher than 0.14 (the maximum estimated value), with an average RBA value of 0.06 across all media for which data are available. The average arsenic RBA value was used when quantifying soil/mine waste ingestion exposures for arsenic. As part of this uncertainty evaluation, risk estimates were determined based on the maximum arsenic RBA to evaluate the potential uncertainty arising from use of the average RBA. Receptors with HI values and/or cancer risk values within a factor of 3 of EPA's acceptable risk levels were evaluated to determine if using a higher media-specific RBA value (e.g., 0.14) would result in an unacceptable non-cancer hazard or cancer risk. A factor of 3 was conservatively chosen because of the ratio of the maximum RBA (0.14) to the average RBA (0.06). Inspection of Table 4-13 reveals the following receptor/exposure unit combinations that warrant evaluation:

- Fisherman in EU9
- Roadway worker in EU1
- Roadway worker in EU4

Substitution of an RBA of 0.14 into the risk calculations (detailed calculations not shown) for these receptors minimally increased non-cancer hazard and cancer risk because arsenic was not a risk driver. Estimated non-cancer hazard and cancer risk would still be within EPA's acceptable risk range even if the maximum arsenic RBA were assumed.

4.4.1.8 Uncertainties in Chromium Valence State

In the environment, chromium may be present in various valence states, but the trivalent form and the hexavalent form are the most predominant, depending upon the nature of the contamination source and environmental conditions (Shahid et al. 2017). In the absence of a specific Cr(VI) source, chromium exists in the environment mainly as Cr(III) (ATSDR 2012; Han et al. 2004). The valence state of chromium in soil at the Site is not known, and data are available only for total chromium. However, given that there are no specific sources of Cr(VI) at the Site, risk calculations assumed a 90% of the chromium was Cr(III) and 10% was Cr(VI). Even if it were assumed 30% of the total chromium concentration were hexavalent chromium, risks would still be within the acceptable risk range (detailed calculations not shown).

4.4.2 Uncertainties in Toxicity Values

Toxicity information for many chemicals is often limited. Consequently, there are varying degrees of uncertainty associated with toxicity values (i.e., SF, RfD, RfC, or IUR). For example, uncertainties can arise from the following sources:

- Extrapolation from animal studies to humans
- Extrapolation from high dose to low dose
- Extrapolation from continuous exposure to intermittent exposure
- Limited or inconsistent toxicity studies

In general, uncertainty in toxicity factors is one of the largest sources of uncertainty in risk estimates at a site. Because of the conservative methods EPA uses in dealing with the uncertainties, it is much more likely that the uncertainty will result in an overestimation rather than an underestimation of risk.

4.4.3 Uncertainties in Risk Estimates

Because risk estimates for a chemical are derived by combining uncertain estimates of exposure and toxicity (see above), the risk estimates for each chemical are more uncertain than either the exposure estimate or the toxicity estimate alone. Additional uncertainty arises from the issue of how to combine risk estimates across different chemicals. In some cases, the effects caused by one chemical do not influence the effects caused by other chemicals. In other cases, the effects of one chemical may interact with effects of other chemicals, causing responses that are approximately additive, greater than additive (synergistic), or less than additive (antagonistic). In most cases, available toxicity data are insufficient to define what type of interaction is expected, so EPA generally assumes effects are additive for non-carcinogens that act on the same target tissue and for carcinogens (all target tissues). Because documented cases of synergistic interactions between chemicals are relatively uncommon, this approach is likely to be reasonable for most chemicals.

For non-carcinogens, summing HQ values across different chemicals is properly applied only to compounds that induce the same effect by the same mechanism of action. Consequently, summation of HQ values for compounds that are not expected to include the same type of effects or that do not act by the same mechanisms could overestimate the potential for effects. Thus, all the HI values in this report, which sum HQ values across multiple metals without regard to the target tissue, are likely to overestimate the true level of human health non-cancer hazard.

Section 5

Evaluating Exposure and Risk from Lead

5.1 Overview

Risks from lead are evaluated using a somewhat different approach than for most other chemicals. First, because lead is widespread in the environment, exposure can occur from many different sources. Thus, lead risks are usually based on consideration of total exposure (all sources) rather than just site-related sources. Second, because studies of lead exposures and resultant health effects in humans have traditionally been described in terms of blood lead level, lead exposures and risks are typically assessed by describing the levels of lead that may occur in the blood of exposed populations and comparing these to blood lead levels of potential health concern. For convenience, the concentration of lead in blood is usually abbreviated PbB, and it is expressed in units of $\mu\text{g}/\text{deciliter}$ (dL).

Concern over health effects from elevated blood lead levels is greatest for young children or the fetus of pregnant women. There are several reasons for this focus on young children or the fetus, including the following: (1) young children typically have higher exposures to lead-contaminated media per unit body weight than adults, (2) young children typically have higher lead absorption rates than adults, and (3) young children and fetuses are more susceptible to effects of lead than are adults.

The EPA Office of Land and Emergency Management (OLEM) Directive 9200.2-167 (EPA 2016g), issued on December 22, 2016, builds on two earlier OLEM (then Office of Solid Waste and Emergency Response [OSWER]) Directives 9355.4-12, July 1994, and 9299.4-27P, August 1998, which established the current approach for addressing lead in soil at CERCLA and Resource Conservation and Recovery Act sites. The directive discusses evidence that adverse health effects are associated with PbB less than $10 \mu\text{g}/\text{dL}$. EPA's Office of Research and Development reviewed the health effects evidence for lead in the 2013 Integrated Science Assessment for Lead and found that several studies have observed "clear evidence of cognitive function decrements [as measured by Full Scale intelligence quotient (IQ), academic performance, and executive function] in young children with mean or group PbB between 2 and $8 \mu\text{g}/\text{dL}$."

In addition, the National Toxicology Program's Monograph on Health Effects of Low-Level Lead found sufficient evidence of delayed puberty, reduced post-natal growth, and decreased hearing for children with PbB below $10 \mu\text{g}/\text{dL}$, and adverse effects on academic achievement, IQ, other cognitive measures, attention-related behaviors, and behavioral problems with PbB below $5 \mu\text{g}/\text{dL}$. For these reasons, target PbBs of 5, 8, and $10 \mu\text{g}/\text{dL}$ have been identified for evaluation in this risk assessment to inform future risk management decisions. EPA has set the goal that there should be no more than a 5% chance that a child will have a blood lead value above these levels. For convenience, the probability of a blood lead value exceeding $5 \mu\text{g}/\text{dL}$, $8 \mu\text{g}/\text{dL}$, and $10 \mu\text{g}/\text{dL}$ is referred to as P5, P8, and P10, respectively.

Although the value of PbB is based on studies in young children, it is generally assumed that the same value is applicable to a fetus in utero. Available data suggest that the ratio of the blood lead level in a fetus to that of the mother is approximately 0.9 (Goyer 1990). For example, PbB in a pregnant female that would correspond to a blood lead level of 5 µg/dL in the fetus is:

$$\text{PbB(mother)} = 5/0.9 = 5.5 \text{ } \mu\text{g/dL}$$

5.2 Lead Exposure Models and Parameters

EPA recommends the use of toxicokinetic models to correlate blood lead concentrations with exposure and adverse health effects. The use of the Integrated Exposure Uptake Biokinetic Model (IEUBK) model is recommended to evaluate exposures from lead-contaminated media in children in a residential setting (EPA 1994b), and the Adult Lead Methodology (ALM) to evaluate potential risks from lead exposure in adults (females of childbearing age) (EPA 2003b). Both the IEUBK model and the ALM can be used to predict blood lead concentrations in exposed individuals and estimate the probability of a blood lead concentration exceeding a level of concern as described below.

5.2.1 IEUBK Model

The IEUBK model developed by EPA predicts the likely range of blood lead levels in a population of young children (aged 0–84 months) exposed to a specified set of environmental lead levels (EPA 1994b). This model requires as input data on the levels of lead in soil, dust, water, air, and diet at a particular location and on the amount of these media ingested or inhaled by a child living at that location. All inputs to the IEUBK model are central tendency point estimates (i.e., CTE). These point estimates are used to calculate an estimate of the central tendency (the GM) of the distribution of blood lead values that might occur in a population of children exposed to the specified conditions. Assuming the distribution is lognormal, and given (as input) an estimate of the variability between different children (the GSD), the model calculates the expected distribution of blood lead values, and estimates the probability that any random child might have a blood lead value over the set target blood lead level (e.g., 8 µg/dL).

5.2.2 Adult Lead Model

The ALM (EPA 2003b, 2009b), based on the work of Bowers et al. (1994), predicts the blood lead level in a person with a Site-related lead exposure by summing the “baseline” blood lead level (PbB0) (that which would occur in the absence of any Site-related exposures) with the increment in blood lead that is expected as a result of increased exposure due to contact with a lead-contaminated Site medium. The latter is estimated by multiplying the average daily absorbed dose of lead from Site-related exposures by a “biokinetic slope factor” (BKSF). Thus, the basic equation for exposure to lead is:

$$\text{PbB} = \text{PbB0} + \text{BKSF} \cdot \Sigma (\text{C}_m \cdot \text{IR}_m \cdot \text{AF}_m)]$$

where:

PbB = Geometric mean blood lead concentration (µg/dL) in women of child-bearing age that are exposed at the Site

PbB0 = “Background” geometric mean blood lead concentration ($\mu\text{g}/\text{dL}$) in women of child-bearing age in the absence of exposures to the Site

BKSF = Biokinetic slope factor ($\mu\text{g}/\text{dL}$ blood lead increase per $\mu\text{g}/\text{day}$ lead absorbed)

C_m = Average lead concentration in medium “m”, expressed in units of $\mu\text{g}/\text{gram}$ (g) (soil), $\mu\text{g}/\text{kg}$ (tissue), $\mu\text{g}/\text{L}$ (water), or $\mu\text{g}/\text{m}^3$ (air)

IR_m = Intake rate of medium “m”, expressed in units of g/day (soil), g/day (tissue), L/day (water), or m^3/day (air)

AF_m = Absorption fraction of lead from medium “m” (dimensionless)

Once the GM blood lead value in adult women who are exposed at the Site is calculated, the full distribution of likely blood lead values in the population of exposed individuals can then be estimated by assuming the distribution is lognormal with a specified individual GSD (GSD_i). The 95th percentile of the predicted distribution is given by the following equation (Aitchison and Brown 1957):

$$95\text{th} = \text{GM} \cdot \text{GSD}_i^{1.645}$$

5.2.3 Evaluation of Intermittent Exposures

Both the IEUBK model and the ALM are designed to evaluate exposures that are approximately continuous (365 days/year). However, for most of the exposure scenarios of concern at the Site, exposures are intermittent, occurring less than 365 days per year (see Tables 4-1 through 4-9).

When exposure is intermittent rather than continuous, the IEUBK and ALM models can still be used by adjusting the Site-related exposure concentration that occurs during the exposure interval to a continuous exposure rate that yields the same total yearly exposure. However, this adjustment is reasonable only in cases where exposure occurs with a relatively constant frequency over a time interval long enough to establish an approximately steady-state response (EPA 2003c). Short-term exposures are not suitable for approximations as continuous exposures. To prevent applications of the lead models to exposure scenarios where an adjustment from intermittent to continuous exposure is not appropriate, EPA (2003c) recommends that these models only be applied to exposures that satisfy two criteria:

- The exposure frequency during the exposure interval is at least 1 day per week
- The duration of the exposure interval is at least 3 consecutive months

Because the child camper (ages 0–6 years old) does not meet both requirements based on CTE exposure frequency (7 days per year), when estimating lead exposures, the exposure frequency was increased to 1 day per week for 3 consecutive months, or 13 days per year. With one exception, all the adult receptors meet the minimum requirements. The adult camper at the USFS campground (EU6) was not included because the minimum exposure frequency requirements were not met based on CTE parameters. For each receptor, continuous exposures were determined such that they accounted for contributions from both impacted media while on-site and unimpacted (background) media while off-site, as described below.

5.2.3.1 IEUBK Model

For the IEUBK model, the average Site lead concentration was adjusted by simulating continuous exposure as follows:

$$C(\text{adjusted}) = C(\text{Site}) \cdot (EF/365) + C(\text{background}) \cdot (365-EF)/365$$

where:

$$C(\text{adjusted}) = \text{TWA lead concentration}$$

$$C(\text{Site}) = \text{Average lead concentration in Site medium}$$

$$EF = \text{Exposure frequency (days/year)}$$

$$C(\text{background}) = \text{Background lead concentration in uncontaminated medium}$$

The background value for soil used in these calculations was 100 mg/kg, which is the mean of upland reference soil samples collected at the Site. For indoor surficial dust, the background level was assumed to be 70% of the concentration in soil (i.e., 100 mg/kg · 0.7 = 70 mg/kg), as is usually assumed in the IEUBK model.

For children who may camp at the USFS campground, the water collected from the well was used as the drinking water source. For children who may camp at the dispersed campsites, surface water samples collected from near the dispersed campsite areas were used as the drinking water source. For water, the background value was assumed to be 0.9 µg/L (EPA 2017e).

5.2.3.2 ALM Model

The same general approach followed for the IEUBK model is followed for the ALM model, excluding the contribution from background. This is because the PbB0 term used in the ALM is intended to represent background exposure to lead. Thus, the average Site lead concentration was adjusted as follows:

$$C(\text{adjusted}) = C(\text{Site}) \cdot (EF/365)$$

5.2.4 IEUBK Model Inputs

Lead risks for children camping at the USFS campground (EU6) or in the dispersed campsites (EU7) were calculated using the IEUBK model. Table 5-1 presents the IEUBK input parameters used in this assessment. All these parameters are EPA defaults except as described below.

Relative Bioavailability

The default value of RBA for lead in soil and dust assumed by the IEUBK model is 0.60 (EPA 2007). Studies of lead RBA at a variety of mine sites suggests this is a typical value, but values at some sites may be higher or lower (EPA 2007). Similar to the approach described above for arsenic, EPA has developed a method for measuring the IVBA of lead in soil. The resultant IVBA results can then be used to estimate RBA values using the following equation (where the IVBA and RBA values are expressed as fractions, not percentages) (EPA 2017d):

$$RBA = 0.878 \cdot IVBA - 0.028$$

EPA measured the IVBA of lead in several dispersed campsite soils, roadway soils, and waste rock samples collected in the mining districts. Table 5-2 presents the lead IVBA and estimated RBA values for these samples. As seen, IVBA values for lead were variable (0.01–0.89), corresponding to RBA values of 0–0.75. The average RBA across all samples was 0.27. This value is lower than the EPA default lead RBA value of 0.60, suggesting that lead is in a form that is less readily absorbed. It is not uncommon for mine waste and soils that are impacted by mining activities to have lower bioavailability because of the nature of the lead forms present in these materials. It is possible that soils and sediments that are less impacted by mining could have higher bioavailability, as observed for the soil in the dispersed campsites where the average RBA is 0.54.

The only child exposure scenario evaluated using the IEUBK model was at campgrounds; the lead RBA used in the IEUBK model was 0.54. Based on a default absolute absorption fraction of 0.50 for lead in water and diet, this RBA corresponds to an absolute bioavailability of 0.27 (27%) for soil and dust in the IEUBK model. See Section 4.4 for a discussion of the potential uncertainty due to RBA assumptions.

Maternal Blood Lead

In accordance with recent EPA guidance (EPA 2017f), an altered maternal blood lead concentration of 0.6 µg/dL was used instead of the IEUBK default 1.0 µg/dL.

Intake Rates

Altered water intake rates, inhalation rates, dietary intake rates, and soil intake rates were used, as summarized in Table 5-1 (EPA 2017e). For the soil/dust intake rates, a time-weighted average was computed using the default residential intake rate to represent time spent off-site, and a camping ingestion rate¹² for time spent on-site camping. As discussed in Section 5.2.3, the exposure frequency assumed for child campers was adjusted to 13 days per year to satisfy the minimum requirements of the IEUBK model. The remainder of the year was assumed to be spent at an off-site residence.

Drinking Water Concentration

An altered drinking water concentration of 0.9 µg/L was used instead of the default of 4 µg/dL for the period when receptors are not at the Site. This alternate drinking water concentration is based on the Lead Technical Review Workgroup (TRW) reanalysis of national drinking water system data reported to EPA (EPA 2017e).

Age Range

In accordance with recent EPA guidance, the age range evaluated was from 12–72 months (EPA 2017e) rather than 0–84 months, which is the default setting in the IEUBK model.

5.2.5 ALM Inputs

Lead risks for adult receptors (women of child-bearing age) were calculated using the ALM. The EPC for soil and other solid media used was the mean concentration. For lead in game, calculations were based on lead in muscle tissue, since lead accumulates in bone and bones are

¹² Values are based on the average of the geometric mean intake rates for boys and girls, as reported in Table 5-6 in the *Child-Specific Exposure Factors Handbook* (USEPA 2008). The geometric mean value for children 5–6 years old was assumed to be equal to the geometric mean for children ages 4–5 years old.

not generally eaten. For lead in fish tissue, calculations were based on lead concentration in fillet samples. Intake rates and exposure frequencies were the same as assumed for CTE non-lead exposures (see Table 4-1 through Table 4-9). Table 5-3 summarizes the ALM-specific input values selected for each scenario. All values are EPA-recommended defaults except as noted below.

Absorption Fraction Values

The ALM model identifies a default absorption fraction (AF) for soluble lead in soil of 0.20, but does not specify AF values for other media. In order to estimate AF values for lead in water, diet, and air, the following assumptions were made:

$$AF(\text{water}) = AF(\text{soluble lead}) = 0.20$$

The assumed AF for water is set equal to the default AF for soluble lead (EPA 2003b). Although the soluble lead AF is likely to be most applicable to dissolved lead in water, applying this AF for exposures to total lead in water is consistent with ALM guidance for drinking water exposures (EPA 2003b) and likely to be conservative.

$$AF(\text{diet}) = 0.20$$

The assumed AF for diet is based on the recommended value for lead in food established in the ALM guidance (EPA 2003b). As acknowledged in the guidance, this assumption may result in an overestimation of absorption from dietary items.

$$AF(\text{air}) = 0.32$$

The assumed AF for air is the same as the default level established for the IEUBK model (EPA 1994b).

Relative Bioavailability

Similar to the approach used for arsenic, when media-specific lead RBA values were available (e.g., campground soil, roadway soil, and waste rock), the average lead RBA for each medium was included in risk calculations. For other solid media (i.e., overbank soils, sediment), the EPA default lead RBA of 0.60 was assumed (EPA 2007). See Section 4.4 for a discussion of the potential uncertainty due to RBA assumptions.

5.2.6 Concentration of Lead in Site Media

For both the IEUBK model and the ALM, the concentration of lead in Site media was calculated using the same approach as was used in the non-lead risk evaluation (as presented in Section 4.1.3), with the following exceptions:

- The EPC was equal to the time-weighted mean soil lead concentration. Similar to the time-weighted intake rate for soil/dust, the concentration of lead in soil was also time-weighted to account for lead exposure while off-site. For the off-site contribution, a background soil lead concentration of 100 mg/kg was used. This value is based on mean concentration for samples collected from upland reference locations. For on-site exposure while camping in dispersed campsites (EU7), a bulk soil lead concentration of 5,703 mg/kg was used (the mean concentration across all dispersed campsites). For on-site exposure while camping at the USFS campground (EU6), a bulk soil lead concentration of 252 mg/kg was used.

- The lead results used to compute the EPC were based on the fine (250- μm) size fraction. An adjustment factor was applied to estimate the fine fraction from the 2-mm result (EPA 2000, 2017e). The adjustment factor was determined by performing a regression analysis of the lead results for samples sieved to 2 mm and to 250 μm . The regression analysis is presented in Figure 5-1. As shown, lead concentrations for the fine fraction were estimated from the bulk concentration, as follows¹³:

$$C_{\text{soil}, 250\text{-}\mu\text{m}} = 1.625 \cdot C_{\text{soil}, 2\text{-mm}} - 226.36$$

where:

$C_{\text{soil}, 250\text{-}\mu\text{m}}$ = Estimated lead concentration in soil for the fine (250- μm) fraction

$C_{\text{soil}, 2\text{-mm}}$ = Measured lead concentration in soil for the bulk (2-mm) fraction

5.3 Results

5.3.1 Risk to Recreational Children

Appendix E presents the IEUBK output files for lead. Table 5-4 summarizes lead risks for recreational children who visit the Site to camp at the USFS campground (EU6) and the dispersed campsites (EU7) for a range of target blood lead levels (5 $\mu\text{g}/\text{dL}$, 8 $\mu\text{g}/\text{dL}$, and 10 $\mu\text{g}/\text{dL}$). This evaluation includes exposures to lead in soil and water used as a drinking water source. As shown, risks appear to be below all target blood lead levels evaluated for the USFS campground. For the dispersed campsites, P8 and P10 values were less than 5%, but P5 values were estimated to be 22%.

Because the IEUBK model is not designed to evaluate short-term exposures, a supplemental lead evaluation was conducted as part of the uncertainty assessment (see Section 5.4).

5.3.2 Risks to Recreational Adults

The ALM evaluated adult exposures to lead due to ingestion/inhalation of soil, incidental ingestion of sediment, incidental ingestion of surface water, ingestion of surface water as drinking water, ingestion of fish, and ingestion of game, as appropriate for the various receptors (see Table 5-3 for complete pathways). Table 5-5, Panel A summarizes the probability of blood lead values exceeding 5 $\mu\text{g}/\text{dL}$, 8 $\mu\text{g}/\text{dL}$, and 10 $\mu\text{g}/\text{dL}$ in the fetuses of pregnant women who may visit the Site for a variety of recreational purposes (i.e., ATV recreational riding, camping, hiking, fishing, and hunting). As shown, risks appear to be well below all target blood lead levels evaluated for all adult recreational receptors. The probability of exceeding the target PbB ranges from 0.01%–0.3%.

Since it is possible for campers to return to the same campsite throughout the year, an additional ALM evaluation was performed to assess potential lead risks from individual camping areas. Table 5-6 summarizes the probability of blood lead values exceeding 5 $\mu\text{g}/\text{dL}$, 8 $\mu\text{g}/\text{dL}$, and 10 $\mu\text{g}/\text{dL}$ in the fetuses of pregnant women on a campsite-specific basis. As seen, with the exception

¹³ In order to be conservative, for cases where the predicted concentration of lead in soil for the fine fraction resulted in a value less than what was measured in the bulk fraction, the concentration in the bulk fraction was adopted. This situation occurs when bulk concentrations are less than about 140 mg/kg.

of dispersed campsites 3, 4, and 7, estimated P5 values were less than 5% for all camping areas. Dispersed campsites 3, 4, and 7 have P5 and P8 values greater than 5%, with campsites 3 and 4 having P10 values greater than 5%.

5.3.3 Risks to Occupational Adults

As shown in Table 5-5, Panel B, risks appear to be well below all target blood lead levels evaluated for all occupational (roadway) workers in EU1, EU3, and EU4, but not EU2. For EU2, P10 and P8 values were less than 5%, but the P5 value was 8%.

These lead risk estimates are based on exposures from ingestion/inhalation of soil and assume an exposure frequency of 100 days per year for 6 hours per day for 10 years within each individual EU. However, long-term roadway worker exposures are not likely to be restricted to a single EU, but would include exposures across multiple EUs. If it were assumed that exposures encompass multiple EUs (area-weighted relative to the approximate road length for each EU), the P5 value for the roadway worker would be approximately 3%.

5.4 Uncertainty Assessment

Quantification of risks to humans from exposures to lead is subject to a number of data limitations and uncertainties. These include:

- Uncertainty in the true average concentration of lead in each environmental medium at each exposure area.
- Uncertainty in the spatial and temporal variability in each of the Site media, as discussed in Section 4.4.1.4.
- Uncertainty in the RBA for various media. Site-specific RBA values were utilized for campsite soil, roadway soil, and waste rock. The measured RBA values for each media type were variable, with the average RBA used in risk calculations. The following bullets discuss whether risk conclusions for lead would differ if a different RBA statistic (i.e., the 95UCL on the mean rather than the arithmetic mean) were used in the lead models:
 - For campsite soil, the average RBA was similar to the default RBA. Because of this, use of the average RBA for campsite soils is unlikely to underestimate risk.
 - For roadway soil, there is an inadequate number of data points to compute a reliable 95UCL, making the arithmetic mean the best estimate of the mean. The lead RBA for roadway soil would have to be 0.27 in an exposure unit in order for P5 to be greater than 5%. Likewise, the RBA for roadway soil would have to be 0.48 in order for P8 to be greater than 5%, and would need to be greater than EPA's default RBA (0.60) in order for P10 to be greater than 5%.
 - For waste rock, the 95UCL is 0.31 (as compared to the average RBA of 0.23). Recognizing that waste rock comprises a minimal amount of the total exposure to receptors at the Site, even if the 95UCL RBA for waste rock were used in the risk estimates, the overall risk conclusions would not change.

- Uncertainty in the true intake rates of each environmental medium by each group of receptors. Values used in these calculations are thought to be conservative (more likely to be high than low).
- Uncertainty in the true absorption rates of lead from each medium.
- Uncertainty in the true relationship between lead intake levels and the resultant increase in blood lead levels, both in children (IEUBK model) and in adults (ALM model).
- Uncertainty in the true variability in exposure and response between different people, which results in uncertainty in the calculation of blood lead levels (Griffin et al. 1999).
- Uncertainty in short duration/intermittent exposures using the IEUBK model. There is considerable uncertainty in using the IEUBK model for evaluating short duration/intermittent exposures. Because of this, an alternate lead modeling approach was considered as part of the uncertainty evaluation. EPA's All Ages Lead Model (AALM) was used to evaluate chronic risk for children who camp in EU7 (dispersed campsites). Focus was placed on this receptor and EU because of the predicted probability of blood lead levels exceeding 5 µg/dL (22%). As noted in Section 5.2.3, the exposure frequency of a CTE receptor is assumed to be 7 days. The age range for evaluation of childhood lead exposure is 12–72 months. With the exception of these values, all other inputs (e.g., RBA, EPCs) that were used for the IEUBK model were incorporated into the AALM model. Figure 5-2 presents the predicted blood lead levels over the period of a child's exposure from age 12–72 months, with 7 consecutive days per year of exposure at a dispersed campsite. As seen, blood lead levels peak when the child is exposed to Site soil, but levels quickly return to a baseline levels. The baseline level does not increase above 5 µg/dL at any time throughout the 12–72-month exposure duration and the P5 is 3.5%, as shown in Figure 5-3. This evaluation suggests that there may be peak blood lead levels that may be of concern, but from a chronic exposure perspective, long-term blood lead levels are below the range of target blood lead levels evaluated. See Section 6 and Appendix F for an evaluation of acute lead risk.

Because of these uncertainties, the values reported above should be understood to be estimates.

5.5 Background Evaluation

Most metals occur naturally in soil and water, especially in mineralized areas where mining occurs. Given the uncertainties in risk estimates, as outlined above, a review of the background data sources available for Site soil was performed to provide prospective regarding Site risk estimates relative to background conditions.

Statistical comparisons to the available background datasets were performed using the procedures recommended in EPA's *Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites* (EPA 2002c). An evaluation of background soil (Table 5-7) was performed based on a comparison of concentrations from Site-specific upland reference soil locations to soil sample results available from Smith et al. (2013), which provide measured metal concentrations for native soils across the United States. Surface soil (depth of 0–5 centimeters) samples from Smith et al. were selected from sampling locations in Colorado that represented a

forested upland environment. Site roadway soil samples from multiple EUs were the focus of the evaluation. The roadway soil samples in the Alpine Loop and all roadway soil samples from the Site were evaluated. Statistical comparisons were made using the two-sample hypothesis testing approach, Form 2 (Wilcoxon Mann-Whitney test), provided in ProUCL v5.1.00 (EPA 2015c) to determine if levels of lead in soil at the Site are present at natural levels or are higher than would be expected. The analysis indicates that lead is elevated in roadway soil samples relative to both background datasets for all EUs evaluated. Thus, lead exposures at the Site are likely to be attributable to mining-related releases.

For informational purposes, a review of the potential risks due to exposure to soil (inhalation and incidental ingestion) in the Site-specific upland reference soil locations was performed using the exposure parameters for the road worker. The detailed calculations are presented in Table 5-8. As shown, estimated lead risks due to exposure to background soil appear to be below EPA's health-based goal (i.e., the probability of exceeding the target PbB is less than 5%).

Section 6

Screening-Level Acute Risk Evaluation

Because acute screening levels are not readily available for evaluating Site media, acute screening levels were derived for lead and arsenic in soil/waste rock based on a camping exposure scenario. Soil/waste rock were evaluated because they represent the majority of exposure for a receptor; exposure to surface water is considered minor relative to solid media exposure. Lead and arsenic were selected for evaluation because soil concentrations are notably elevated at several locations within the mining districts and both are often important human health risk drivers for mining-related contamination. The camping scenario was selected for the derivation of acute screening levels because the camper is anticipated to be the most sedentary of receptors (i.e., not moving about being exposed to a variety of soil/mine waste sources, in contrast with hiker, hunter, fisherman, ATV guide and recreational rider, and road worker receptors). Derivation of screening levels for a sedentary receptor allows for the application of these screening levels to smaller exposure areas, such as individual campgrounds and dispersed areas suitable for camping.

Focus was placed on evaluating acute exposures to children because children are often more vulnerable to pollutants than adults because of differences in behavior and biology that can lead to greater exposure and/or unique windows of susceptibility during development. Additionally, soil ingestion rates for young children are higher than adults due to increased frequency of contact through hand-to-mouth or object-to-mouth activity. Thus, exposure parameters used in the derivation of the acute screening levels were tailored for children 2 years of age. Two exposure scenarios for a child that may camp within the mining districts were evaluated:

- Scenario 1: Child, based on CTE soil intake rates specific to a camping exposure scenario
- Scenario 2: Child, based on RME soil intake rates specific to a camping exposure scenario

This section presents an overview of the detailed acute risk evaluation presented in Appendix F.

6.1 Derivation of Acute Screening Levels

6.1.1 Lead

For lead, the AALM was used for evaluating short-term exposure scenarios. The AALM is still in development, however, a beta version (FORTRAN 1.0) of this model is available (upon EPA request) and was used in researching effects of lead exposures at various life stages to support the development of the acute screening levels.

Acute screening levels for lead were developed based on a 2-day and 14-day exposure to soil/waste rock using the inputs provided in Appendix F and for the two exposure scenarios described above. The acute screening levels were derived by determining the soil/waste rock concentration that would result in a predicted peak PbB concentration of 19.5 µg/dL. Per EPA (2016h), a PbB level of 20 µg/dL could be considered as a short-term elevation in PbB that would trigger a response action. This is based on the interpretation of the Center for Disease Control

(CDC) recommendation that PbB levels in the range of 20–44 µg/dL would result in a home visit by a public health agency within 24 hours of a referral from a physician (CDC 2012). For the purposes of this evaluation, 19.5 µg/dL was selected as target PbB for establishing an acute screening level to account for rounding to two significant digits. Table 6-1 presents the acute screening levels for lead based on a 2-day and 14-day exposure for soil and waste rock.

6.1.2 Arsenic

Acute toxicity information is generally lacking for arsenic, and acute arsenic screening levels specific to the type of receptors present within the mining districts (i.e., recreational visitors) are not available. Washington State Department of Health (WSDOH) provides a synopsis of published scientific information related to soil exposure and acute toxicity in *Hazards of Short-term Exposure to Arsenic Contaminated Soil* (WSDOH 1999). Transient adverse health effects commonly occur when doses between 0.035 and 0.071 milligrams of arsenic per kilogram of body weight (mg/kg BW) are ingested. The best estimate of an acute threshold for transient effects is 0.05 mg/kg BW. Using the acute transient effect dose information, acute arsenic screening levels were derived for the same two exposure scenarios that were evaluated for lead. Table 6-2 presents the acute screening levels for arsenic based on a 2-day and 14-day exposure for soil and waste rock.

6.2 Acute Risk Evaluation

For the acute risk evaluation, exposure was assumed to occur over a small exposure area compared to the chronic risk evaluation. In the chronic evaluation, exposures were evaluated for larger EUs, but in the acute evaluation, exposures were evaluated for individual sampling locations. When making comparisons to samples collected from camping areas, the 14-day screening level was selected. When making comparisons to samples from waste rock areas, the 2-day screening level was selected. Samples collected from waste rock areas are more remote (i.e., less accessible) and are not representative of areas that are frequently used for camping.

6.2.1 Lead

For the camping area soils, there are multiple samples with lead concentrations that exceed the 14-day CTE and RME acute screening levels, as shown in Figure F-2 in Appendix F. Because it may be unreasonable to assume that RME soil ingestion rates, which are specific to a camping scenario, are realistic for 14 days, it may be more appropriate to focus on samples that exceed the CTE acute screening level. Considering this, samples collected from dispersed campsites 2, 3, 4, and 7 had the greatest exceedance margin of the CTE screening level.

For waste rock, there were many samples that exceeded the 2-day CTE and RME acute screening levels. However, evaluation of the locations where samples were collected is a critical step in the risk management decision process. When evaluating samples in exceedance of the acute screening levels, the physical attributes of the location from which the sample was collected should be considered. For example, samples collected from the steep slopes of a waste pile are not representative of areas where camping may occur. Thus, application of the acute camping screening levels to these areas would be inappropriate.

For the upland reference soils, there were a few exceedances of the RME screening level, but no exceedances of the CTE screening level. This indicates that lead concentration in areas at the Site

that are not impacted by mining activities would not pose an acute risk to campers based on typical soil ingestion rates. However, if the soil ingestion rate were to be at an RME level for 14 consecutive days, acute risks have the potential to be unacceptable in upland reference areas. Because unacceptable exposures are not expected in unimpacted areas, this further supports the conclusion that the 14-day RME screening level is likely to be overly conservative. This should be taken into consideration during risk management decision-making.

6.2.2 Arsenic

For the camping area soil, concentrations of arsenic do not exceed the 14-day CTE acute screening level, but there were some locations with soil concentrations greater than the RME screening level, as shown in Figure F-3 in Appendix F. For waste rock, there were four samples (collected from three mining areas, including the Koehler Mine, Junction Mine, and Longfellow Mine) that exceeded the 2-day CTE acute screening level and three additional samples that exceeded the RME screening level. For the upland reference soils, the measured arsenic concentrations are below the range of possible screening levels for all samples.

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Section 7

Conclusions

This document presents the results of a baseline HHRA for Bonita Peak Mining District Superfund Site. Specifically, the HHRA evaluated exposures within the mining districts in the Mineral Creek, Cement Creek, and Upper Animas River drainages. The HHRA evaluated potential risks to humans, both now and in the future, from exposures to contaminants that may be present in the mining districts, assuming that no steps are taken to remediate the environment or to reduce human contact with contaminated environmental media.

The Site consists of historic mines and mining-related sources that have resulted in the direct deposition of various types of solid wastes (tailings and waste rock) that were placed onto soil near the mines or were discharged into nearby streams. In addition, contaminated water from mine adits discharges directly into streams. Metals are the primary COPCs at the Site.

The mining districts are primarily used by humans for recreational, occupational, and tribal purposes. The receptor populations of interest for the risk assessment included campers, hikers, hunters, recreational fishermen, ATV recreational riders, ATV guides, and county road workers. An addendum to this risk assessment will be developed to evaluate tribal exposures once the necessary exposure data are available.

The HHRA included an evaluation of chronic exposures to both lead and non-lead COPCs and a screening-level evaluation of acute exposures from lead and arsenic. The overall risk conclusions of these evaluations are summarized below.

7.1 Chronic Exposure

The sections below provide a summary of risks to receptors at the Site from chronic exposure. Chronic exposure and risk to humans from non-lead COPCs were evaluated based on both cancer and non-cancer effects. Risks from lead were evaluated using a different approach in which exposure models were used to estimate blood lead levels for the two receptor types of primary interest (i.e., young children and women of child-bearing age).

7.1.1 Non-Lead COPCs

Estimated risks to recreational and occupational receptors at the Site from exposure to non-lead COPCs in a variety of media are within the EPA's acceptable risk guidelines for non-cancer and cancer effects (Table 4-13). Based on this, it is concluded that Site-related risks from chronic exposure to non-lead COPCs for recreational and occupational receptors are below a level of concern.

7.1.2 Lead

The following conclusions pertain to the range of receptors evaluated for lead exposure. When estimating potential risks from exposures to lead, a range of target blood lead levels (from 5–10

µg/dL) was evaluated. Risk managers will need to determine the appropriate target to support project decision-making.

- Camper (child, age 12–72 months) – For the USFS campground, estimated risks are below EPA’s health-based goal, regardless of the target blood lead level. For the dispersed campsites, the probability of exceeding EPA’s health-based goal was less than 5% based on target blood lead levels of 8 µg/dL and 10 µg/dL, but not based on a target of 5 µg/dL (P5 was 22%).
- Adult recreational receptors (ATV guide, ATV recreational rider, dispersed camper, hiker, fisherman, and hunter) – Estimated lead risks appear to be well below all target blood lead levels evaluated for all adult recreational receptors (P5 values range from 0.01%–0.3%). However, the evaluation of the dispersed campsites assumed average exposure across of all dispersed campsites. An evaluation of lead risk for individual campsites revealed three dispersed campsites (campsites 3, 4, and 7) have potentially unacceptable lead risks, if these campsites were used exclusively. For these three dispersed campsites, P5 and P8 values were greater than 5%, and campsites 3 and 4 had P10 values greater than 5%.
- Roadway worker – Estimated lead risks are below EPA’s health-based goal, regardless of the target blood lead level. The P5 value was approximately 3% if it were assumed the exposures spanned multiple EUs (i.e., exposures were area-weighted relative to the approximate road length for each EU).

7.2 Acute Exposure

The sections below provide a summary of the screening-level evaluation of risks to receptors at the Site from acute exposure. As part of this evaluation, acute screening levels were developed for lead and arsenic to provide a means to screen available soil and waste rock samples to identify locations where acute exposures have the potential to be unacceptable. There are two types of acute screening levels: one based on a 14-day exposure duration, which is applicable to camping areas, and one based on a 2-day exposure duration, which is applicable to waste rock areas. Although two exposure scenarios (CTE and RME) were evaluated, it is likely that the CTE scenario is the most appropriate when evaluating camping area soil samples and the RME scenario is most appropriate when evaluating waste rock samples.

7.2.1 Lead

For camping areas, there are several soil samples with lead concentrations that exceed the 14-day CTE acute screening level. Samples collected from dispersed campsites 2, 3, 4, and 7 had the greatest exceedance margin of the 14-day CTE acute screening result.

For waste rock, there were many samples that exceeded the 2-day RME screening level. However, risk managers must consider the physical attributes of the sampling location to support remedial decision-making. For example, application of the acute screening levels, which are based on a camping exposure scenario, would not be appropriate for samples collected from a steep slope or have other attributes that would make the location undesirable for camping.

7.2.2 Arsenic

For the camping area soils, concentrations of arsenic do not exceed the 14-day CTE acute screening level. However, there were several waste samples that exceeded the 2-day RME acute screening level. The highest screening level exceedances were for waste rock samples collected from the Koehler Mine, Junction Mine, and Longfellow Mine.

Quantitative evaluation of the risks to humans from environmental contamination is frequently limited by uncertainty regarding a number of key data items, including concentration levels in the environment, the true level of human contact with contaminated media, and the true dose-response curves for non-cancer and cancer effects in humans. This uncertainty is usually addressed by making assumptions or estimates for uncertain parameters based on whatever limited data are available. Because of these assumptions and estimates, the results of risk calculations are themselves uncertain, and it is important for risk managers and the public to keep this in mind when interpreting the results of a risk assessment.

Site managers will also consider the results of the ecological risk assessment and any regulatory requirements in determining appropriate remedial actions for the Site. As appropriate, discussions and recommendations on how to manage potential risks will be provided in the Feasibility Study. The identification of remedial action levels, which will guide future remediation efforts, will be provided in the Record of Decision.

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Section 8

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Tables

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TABLE 2-1
SUMMARY STATISTICS FOR SOIL AND MINE WASTE
Bonita Peak Mining District

Panel A: Locations Within the Mining Districts

Analyte	CAS	N Samples	N Detected Samples	Detection Frequency	Mean Concentration (mg/kg)*	Standard Deviation (mg/kg)*	Maximum Detected Concentration (mg/kg)	Mean MDL of NDs (mg/kg)*
Aluminum	7429-90-5	520	520	100%	9,597	5,011	48,300	--
Antimony	7440-36-0	513	450	88%	10	31	332	0.18
Arsenic	7440-38-2	519	518	99.8%	86	623	13,700	0.070
Barium	7440-39-3	484	483	99.8%	107	97	1,110	0.027
Beryllium	7440-41-7	519	369	71%	0.63	0.72	9.0	0.35
Cadmium	7440-43-9	520	476	92%	6.9	19	216	0.030
Calcium	7440-70-2	520	509	98%	3,203	5,978	86,000	8.5
Chromium	7440-47-3	520	516	99.2%	4.6	2.2	17	0.77
Cobalt	7440-48-4	484	481	99%	8.9	11	126	0.16
Copper	7440-50-8	520	518	99.6%	256	463	3,830	0.026
Iron	7439-89-6	520	520	100%	37,066	31,441	317,000	--
Lead	7439-92-1	520	520	100%	2,312	4,672	44,200	--
Magnesium	7439-95-4	520	520	100%	3,739	2,123	11,500	--
Manganese	7439-96-5	519	519	100%	4,430	10,134	96,100	--
Mercury	7439-97-6	510	475	93%	0.22	0.59	7.6	0.0017
Molybdenum	7439-98-7	350	280	80%	9.0	18	159	0.099
Nickel	7440-02-0	520	514	99%	4.6	5.1	67	0.38
Potassium	7440-09-7	67	67	100%	1,129	603	2,940	--
Selenium	7782-49-2	520	409	79%	1.7	2.1	32	0.43
Silver	7440-22-4	517	460	89%	7.5	13	97	0.10
Sodium	7440-23-5	198	76	38%	99	48	325	96
Strontium	7440-24-6	98	98	100%	33	23	152	--
Thallium	7440-28-0	512	226	44%	0.41	0.64	6.0	0.24
Vanadium	7440-62-2	484	484	100%	18	9	76	--
Zinc	7440-66-6	520	520	100%	1,592	4,346	66,800	--

Panel B: Upland Soil Reference Locations

Analyte	CAS	N Samples	N Detected Samples	Detection Frequency	Mean Concentration (mg/kg)*	Standard Deviation (mg/kg)*	Maximum Detected Concentration (mg/kg)	Mean MDL of NDs (mg/kg)
Aluminum	7429-90-5	34	34	100%	9,257	3,178	14,600	--
Antimony	7440-36-0	34	14	41%	0.37	0.27	1.2	0.20
Arsenic	7440-38-2	34	34	100%	10	8.3	26	--
Barium	7440-39-3	34	34	100%	175	81	456	--
Beryllium	7440-41-7	34	5	15%	0.58	0.71	3.3	0.37
Cadmium	7440-43-9	34	34	100%	0.91	1.5	6.5	--
Calcium	7440-70-2	34	34	100%	5,917	5,301	21,400	--
Chromium	7440-47-3	34	34	100%	6.1	1.2	9.2	--
Cobalt	7440-48-4	34	34	100%	6.1	2.8	14	--
Copper	7440-50-8	34	34	100%	23	15	79	--
Iron	7439-89-6	34	34	100%	18,194	11,280	62,000	--
Lead	7439-92-1	34	34	100%	100	120	431	--
Magnesium	7439-95-4	34	34	100%	3,109	1,136	5,560	--
Manganese	7439-96-5	34	34	100%	1,249	1,306	7,020	--
Mercury	7439-97-6	34	34	100%	0.087	0.10	0.61	--
Molybdenum	7439-98-7	17	7	41%	1.8	2.3	7.3	0.50
Nickel	7440-02-0	34	34	100%	5.3	2.7	15	--
Potassium	7440-09-7	34	34	100%	1,237	334	1,950	--
Selenium	7782-49-2	34	8	24%	0.59	0.49	2.2	0.37
Silver	7440-22-4	34	15	44%	0.48	0.43	1.6	0.21
Sodium	7440-23-5	34	0	0%	93	31	All ND	93
Strontium	7440-24-6	17	17	100%	72	60	188	--
Thallium	7440-28-0	34	2	6%	0.43	0.28	1.7	0.36
Vanadium	7440-62-2	34	34	100%	18	5.6	29	--
Zinc	7440-66-6	34	34	100%	138	117	527	--

Notes:

*Non-detects were evaluated at 1/2 the method detection limit (MDL)

-- not applicable

mg/kg = milligram per kilogram

MDL = method detection limit

N = number

ND = non-detect

TABLE 2-2
SUMMARY STATISTICS FOR SEDIMENT
Bonita Peak Mining District

Analyte	CAS	N Samples	N Detected Samples	Detection Frequency	Mean Conc. (mg/kg)*	Standard Deviation (mg/kg)*	Maximum Detected Conc. (mg/kg)	Mean DL of NDs (mg/kg)*
Aluminum	7429-90-5	660	660	100%	13,019	8,210	61,600	--
Antimony	7440-36-0	649	468	72%	2.3	4.0	43	0.015
Arsenic	7440-38-2	660	656	99%	68	220	3,080	0.012
Barium	7440-39-3	515	515	100%	88	57	454	--
Beryllium	7440-41-7	660	522	79%	2.1	4.0	48	0.015
Cadmium	7440-43-9	660	614	93%	7.4	19	268	0.0070
Calcium	7440-70-2	660	652	99%	2,477	1,823	19,000	0.18
Chromium	7440-47-3	658	638	97%	3.9	2.2	37	0.21
Cobalt	7440-48-4	515	512	99%	14	12	86	0.0027
Copper	7440-50-8	660	657	100%	264	539	6,560	0.17
Iron	7439-89-6	660	660	100%	62,136	80,217	926,000	--
Lead	7439-92-1	660	659	100%	1,020	2,330	26,900	0.020
Magnesium	7439-95-4	660	657	100%	4,281	2,154	16,100	1.8
Manganese	7439-96-5	660	660	100%	5,613	8,884	112,000	--
Mercury	7439-97-6	552	491	89%	0.13	0.60	13	0.00042
Molybdenum	7439-98-7	248	161	65%	4.8	8.5	88	0.0041
Nickel	7440-02-0	659	648	98%	6.6	5.8	80	0.10
Potassium	7440-09-7	468	461	99%	922	667	7,900	14
Selenium	7782-49-2	639	471	74%	1.4	6.9	174	0.056
Silver	7440-22-4	656	537	82%	3.0	5.2	43	0.019
Sodium	7440-23-5	468	89	19%	22	41	231	4.6
Strontium	7440-24-6	145	142	98%	43	60	684	0.066
Thallium	7440-28-0	634	264	42%	0.56	6.81	171	0.025
Vanadium	7440-62-2	515	514	100%	21	12	141	0.10
Zinc	7440-66-6	660	660	100%	1,692	3,181	37,300	--

Notes:

*Non-detects were evaluated at 1/2 the method detection limit (MDL)

-- = not applicable

Conc. = concentration

DL = detection limit

MDL = method detection limit

mg/kg = milligram per kilogram

N = number

ND = non-detect

TABLE 2-3
SUMMARY STATISTICS FOR SURFACE WATER
Bonita Peak Mining District

Analyte	CAS	N Samples	N Detected Samples	Detection Frequency	Average Concentration (µg/L)*	Standard Deviation (µg/L)*	Maximum Detected Concentration (µg/L)	Mean DL of NDs (µg/L)*
Aluminum	7429-90-5	2039	1928	95%	3,050	6,965	79,300	9
Antimony	7440-36-0	1822	28	2%	1.2	0.61	12.5	1.2
Arsenic	7440-38-2	2032	369	18%	15	196	6,400	1.2
Barium	7440-39-3	860	254	30%	18	18	280	13
Beryllium	7440-41-7	2032	315	16%	1.9	7.9	185.0	1.0
Cadmium	7440-43-9	2039	1477	72%	7.8	37	1,090	0.24
Calcium	7440-70-2	2065	2060	100%	67,676	83,849	475,000	50
Chromium	7440-47-3	2039	96	5%	2.5	1.15	24.3	2.4
Cobalt	7440-48-4	860	539	63%	10.7	27	227	0.24
Copper	7440-50-8	2039	1613	79%	180	832	12,300	1.2
Iron	7439-89-6	2032	1485	73%	8,278	26,028	398,000	50
Lead	7439-92-1	2039	1640	80%	45	226	4,550	0.22
Magnesium	7439-95-4	2065	2060	100%	5,953	7,444	67,900	50.0
Manganese	7439-96-5	2039	1948	96%	4,321	12,687	200,000	1.0
Mercury	7439-97-6	130	0	0%	0	0	All ND	0.028
Molybdenum	7439-98-7	333	20	6%	2.9	1.5	17.8	2.6
Nickel	7440-02-0	2032	840	41%	6.7	15	208	1.2
Potassium	7440-09-7	1042	900	86%	695	591	6,470	110
Selenium	7782-49-2	2032	24	1.2%	2.4	0.87	19.1	2.4
Silver	7440-22-4	2032	14	0.7%	1.2	0.61	20	1.2
Sodium	7440-23-5	1043	1024	98%	2,652	2,945	37,200	125
Strontium	7440-24-6	1172	1172	100%	730	1,260	13,100	--
Thallium	7440-28-0	2032	204	10%	2.9	3.3	85	2.2
Vanadium	7440-62-2	860	172	20%	4.6	3.5	58.50	5
Zinc	7440-66-6	2039	1893	93%	2,670	9,768	278,000	5

Notes:

*Non-detects were evaluated at 1/2 the method detection limit (MDL)

-- = not applicable

µg/L = microgram per liter

DL = detection limit

MDL = method detection limit

N = number

ND = non-detect

TABLE 2-4
SUMMARY STATISTICS FOR GROUNDWATER
Bonita Peak Mining District

Analyte	CAS	N Samples	N Detected Samples	Detection Frequency	Maximum Detected Concentration (µg/L)	Mean DL of NDs (µg/L)*
Aluminum	7429-90-5	2	0	0%	All ND	3.0
Antimony	7440-36-0	2	0	0%	All ND	0.075
Arsenic	7440-38-2	2	0	0%	All ND	0.075
Barium	7440-39-3	1	1	100%	40	--
Beryllium	7440-41-7	2	0	0%	All ND	0.063
Cadmium	7440-43-9	2	0	0%	All ND	0.014
Calcium	7440-70-2	1	1	100%	42300	--
Chromium	7440-47-3	2	1	50%	2.0	0.25
Copper	7440-50-8	2	2	100%	11	--
Iron	7439-89-6	2	0	0%	All ND	3.8
Lead	7439-92-1	2	1	50%	0.30	0.025
Magnesium	7439-95-4	1	1	100%	3700	--
Manganese	7439-96-5	2	0	0%	All ND	0.063
Mercury	7439-97-6	1	0	0%	All ND	0.010
Nickel	7440-02-0	2	1	50%	1.0	0.13
Selenium	7782-49-2	2	0	0%	All ND	0.15
Silver	7440-22-4	2	1	50%	0.12	0.13
Sodium	7440-23-5	1	1	100%	3500	--
Strontium	7440-24-6	1	1	100%	370	--
Thallium	7440-28-0	2	0	0%	All ND	0.13
Zinc	7440-66-6	2	2	100%	120	--

Notes:

*Non-detects were evaluated at 1/2 the method detection limit (MDL)

-- = not applicable

µg/L = microgram per liter

DL = detection limit

MDL = method detection limit

N = number

ND = non-detect

TABLE 2-5
SUMMARY STATISTICS FOR FISH TISSUE
Bonita Peak Mining District

Panel A: Locations Within the Mining Districts

Analyte	CAS	N Samples	N Detected Samples	Detection Frequency	Average Concentration (mg/kg, wet weight)*	Standard Deviation (mg/kg, wet weight)*	Maximum Detected Concentration (mg/kg, wet weight)	Mean DL of NDs (mg/kg, wet weight)*
Aluminum	7429-90-5	13	0	0%	1.1	0.092	All ND	1.1
Antimony	7440-36-0	13	0	0%	0.027	0.0023	All ND	0.027
Arsenic	7440-38-2	13	7	54%	0.19	0.21	0.55	0.026
Beryllium	7440-41-7	13	0	0%	0.053	0.0046	All ND	0.053
Cadmium	7440-43-9	13	13	100%	0.041	0.024	0.080	--
Calcium	7440-70-2	13	13	100%	191	52	340	--
Chromium	7440-47-3	13	13	100%	0.89	0.19	1.5	--
Copper	7440-50-8	13	13	100%	0.48	0.094	0.67	--
Iron	7439-89-6	13	0	0%	5.3	0.46	All ND	5.3
Lead	7439-92-1	13	12	92%	0.031	0.023	0.07	0.0050
Magnesium	7439-95-4	13	13	100%	227	13	247	--
Manganese	7439-96-5	13	3	23%	0.15	0.10	0.42	0.11
Mercury	7439-97-6	13	13	100%	0.032	0.012	0.058	--
Nickel	7440-02-0	13	0	0%	0.027	0.0023	All ND	0.027
Selenium	7782-49-2	13	13	100%	0.70	0.22	0.99	--
Silver	7440-22-4	13	0	0%	0.027	0.0023	All ND	0.027
Strontium	7440-24-6	13	12	92%	0.46	0.25	0.90	0.11
Thallium	7440-28-0	13	0	0%	0.053	0.0046	All ND	0.053
Uranium	7440-61-1	13	0	0%	0.0053	0.00046	All ND	0.0053
Zinc	7440-66-6	13	13	100%	11	4.0	21	--

Panel B: Reference Locations

Analyte	CAS	N Samples	N Detected Samples	Detection Frequency	Average Concentration (mg/kg, wet weight)*	Standard Deviation (mg/kg, wet weight)*	Maximum Detected Concentration (mg/kg, wet weight)	Mean DL of NDs (mg/kg, wet weight)*
Aluminum	7429-90-5	10	1	10%	1.2	0.43	2.5	1.1
Antimony	7440-36-0	10	0	0%	0.028	0.0014	All ND	0.028
Arsenic	7440-38-2	10	5	50%	0.081	0.064	0.21	0.027
Beryllium	7440-41-7	10	0	0%	0.055	0.0029	All ND	0.055
Cadmium	7440-43-9	10	6	60%	0.018	0.014	0.045	0.0055
Calcium	7440-70-2	10	10	100%	138	26	176	--
Chromium	7440-47-3	10	10	100%	0.87	0.040	0.92	--
Copper	7440-50-8	10	10	100%	0.42	0.056	0.54	--
Iron	7439-89-6	10	0	0%	5.5	0.27	All ND	5.5
Lead	7439-92-1	10	6	60%	0.041	0.052	0.14	0.0055
Magnesium	7439-95-4	10	10	100%	248	8.2	266	--
Manganese	7439-96-5	10	2	20%	0.20	0.20	0.61	0.11
Mercury	7439-97-6	10	8	80%	0.030	0.012	0.044	0.012
Nickel	7440-02-0	10	0	0%	0.028	0.0014	All ND	0.028
Selenium	7782-49-2	10	10	100%	0.74	0.20	1.2	--
Silver	7440-22-4	10	0	0%	0.028	0.0014	All ND	0.028
Strontium	7440-24-6	10	9	90%	0.36	0.17	0.67	0.11
Thallium	7440-28-0	10	0	0%	0.055	0.0027	All ND	0.055
Uranium	7440-61-1	10	0	0%	0.0055	0.00027	All ND	0.0055
Zinc	7440-66-6	10	10	100%	5.9	1.2	7.8	--

Notes:

*Non-detects were evaluated at 1/2 the method detection limit (MDL)

-- = not applicable

MDL = method detection limit

mg/kg = milligrams per kilogram

N = number

ND = non-detect

TABLE 2-6
SUMMARY STATISTICS FOR GAME TISSUE – GROUSE
Bonita Peak Mining District

Analyte	CAS	N Samples ^[a]	N Detected Samples	Detection Frequency	Average Concentration (mg/kg, wet weight) ^[b]	Standard Deviation (mg/kg, wet weight) ^[b]	Maximum Detected Concentration (mg/kg, wet weight)	Mean DL of NDs (mg/kg) ^[b]
Aluminum	7429-90-5	3	0	0%	1.4	0.033	All ND	1.4
Antimony	7440-36-0	3	0	0%	0.035	0.00080	All ND	0.035
Arsenic	7440-38-2	3	0	0%	0.035	0.00080	All ND	0.035
Barium	7440-39-3	3	0	0%	0.035	0.00080	All ND	0.035
Beryllium	7440-41-7	3	0	0%	0.069	0.0016	All ND	0.069
Cadmium	7440-43-9	3	1	33%	0.012	0.0094	0.023	0.0069
Calcium	7440-70-2	3	3	100%	30	0.66	31	--
Chromium	7440-47-3	3	3	100%	0.84	0.030	0.87	--
Cobalt	7440-48-4	3	0	0%	0.0069	0.00016	All ND	0.0069
Copper	7440-50-8	3	3	100%	0.49	0.021	0.51	--
Iron	7439-89-6	3	0	0%	6.9	0.16	All ND	6.9
Lead	7439-92-1	3	1	33%	0.042	0.060	0.11	0.0069
Magnesium	7439-95-4	3	3	100%	331	4.8	335	--
Manganese	7439-96-5	3	0	0%	0.14	0.0033	All ND	0.14
Mercury	7439-97-6	3	0	0%	0.0063	0.00064	All ND	0.0063
Molybdenum	7439-98-7	3	0	0%	0.069	0.0016	All ND	0.069
Nickel	7440-02-0	3	0	0%	0.035	0.00080	All ND	0.035
Potassium	7440-09-7	3	3	100%	3746	210	3988	--
Selenium	7782-49-2	3	0	0%	0.069	0.0016	All ND	0.069
Silver	7440-22-4	3	0	0%	0.035	0.00080	All ND	0.035
Sodium	7440-23-5	3	3	100%	522	158	643	--
Strontium	7440-24-6	3	0	0%	0.14	0.0033	All ND	0.14
Thallium	7440-28-0	3	0	0%	0.069	0.0016	All ND	0.069
Vanadium	7440-62-2	3	0	0%	0.14	0.0033	All ND	0.14
Zinc	7440-66-6	3	3	100%	4.9	0.036	4.9	--

Notes:

[a] Includes grouse muscle tissue collected from the breast.

[b] Non-detects were evaluated at 1/2 the method detection limit (MDL)

-- = not applicable

MDL = method detection limit

mg/kg = milligrams per kilogram

N = number

ND = non-detect

TABLE 2-7
SUMMARY STATISTICS FOR GAME TISSUE – DEER
Bonita Peak Mining District

Analyte	CAS	N Samples ^[a]	N Detected Samples	Detection Frequency	Average Concentration (mg/kg, wet weight) ^[b]	Standard Deviation (mg/kg, wet weight) ^[b]	Maximum Detected Concentration (mg/kg, wet weight)	Mean DL of NDs (mg/kg) ^[b]
Aluminum	7429-90-5	8	0	0%	1.3	0.095	All ND	1.3
Antimony	7440-36-0	8	0	0%	0.032	0.0024	All ND	0.032
Arsenic	7440-38-2	8	0	0%	0.032	0.0024	All ND	0.032
Barium	7440-39-3	8	0	0%	0.032	0.0024	All ND	0.032
Beryllium	7440-41-7	8	0	0%	0.065	0.0048	All ND	0.065
Cadmium	7440-43-9	8	0	0%	0.0065	0.00048	All ND	0.0065
Calcium	7440-70-2	8	8	100%	33	4.5	39	--
Chromium	7440-47-3	8	8	100%	0.75	0.042	0.80	--
Cobalt	7440-48-4	8	0	0%	0.0065	0.00048	All ND	0.0065
Copper	7440-50-8	8	8	100%	1.6	0.43	2.2	--
Iron	7439-89-6	8	8	100%	25	7.1	35	--
Lead	7439-92-1	8	1	13%	0.0081	0.0044	0.019	0.0065
Magnesium	7439-95-4	8	8	100%	245	35	279	--
Manganese	7439-96-5	8	2	25%	0.18	0.087	0.35	0.13
Mercury	7439-97-6	8	0	0%	0.0081	0.0020	All ND	0.0081
Molybdenum	7439-98-7	8	0	0%	0.065	0.0048	All ND	0.065
Nickel	7440-02-0	8	1	13%	0.039	0.018	0.083	0.033
Potassium	7440-09-7	8	8	100%	3610	439	3896	--
Selenium	7782-49-2	8	4	50%	0.14	0.084	0.27	0.063
Silver	7440-22-4	8	0	0%	0.032	0.0024	All ND	0.032
Sodium	7440-23-5	8	8	100%	342	60	433	--
Strontium	7440-24-6	8	0	0%	0.13	0.0095	All ND	0.13
Thallium	7440-28-0	8	0	0%	0.065	0.0048	All ND	0.065
Vanadium	7440-62-2	8	0	0%	0.13	0.0095	All ND	0.13
Zinc	7440-66-6	8	8	100%	30	16	65	--

Notes:

[a] Includes deer muscle tissue collected from the backstrap, front roast, back roast, and tenderloin.

[b] Non-detects were evaluated at 1/2 the method detection limit (MDL)

-- = not applicable

MDL = method detection limit

mg/kg = milligrams per kilogram

N = number

ND = non-detect

TABLE 2-8
SUMMARY STATISTICS FOR ROADWAY AIR
Bonita Peak Mining District

Analyte	CAS	N Samples	N Detected Samples	Detection Frequency	Average Concentration ($\mu\text{g}/\text{m}^3$)*	Standard Deviation ($\mu\text{g}/\text{m}^3$)*	Maximum Detected Concentration ($\mu\text{g}/\text{m}^3$)	Mean DL of NDs ($\mu\text{g}/\text{m}^3$)*
Arsenic	7440-38-2	9	0	0%	0.0047	0.000055	All ND	0.0047
Chromium	7440-47-3	9	9	100%	0.20	0.019	0.23	--
Lead	7439-92-1	9	5	56%	0.033	0.060	0.19	0.033
Manganese	7439-96-5	9	9	100%	0.10	0.11	0.37	--

Notes:

*Non-detects were evaluated at 1/2 the method detection limit (MDL)

-- = not applicable

MDL = method detection limit

$\mu\text{g}/\text{m}^3$ = micrograms per cubic meter

N = number

ND = non-detect

TABLE 2-9
SUMMARY STATISTICS FOR ACTIVITY-BASED SAMPLING AIR
Bonita Peak Mining District

Analyte	CAS	N Samples	N Detected Samples	Detection Frequency	Average Concentration ($\mu\text{g}/\text{m}^3$)*	Standard Deviation ($\mu\text{g}/\text{m}^3$)*	Maximum Detected Concentration ($\mu\text{g}/\text{m}^3$)	Mean DL of NDs ($\mu\text{g}/\text{m}^3$)*
Aluminum	7429-90-5	16	12	75%	8	7.9	35	3.1
Arsenic	7440-38-2	16	0	0%	1.2	0.46	All ND	1.2
Beryllium	7440-41-7	16	0	0%	0.0063	0.0023	All ND	0.0063
Cadmium	7440-43-9	16	0	0%	0.038	0.014	All ND	0.038
Calcium	7440-70-2	16	2	13%	8.3	3.8	19	7.6
Chromium	7440-47-3	16	0	0%	0.63	0.23	All ND	0.63
Copper	7440-50-8	16	2	13%	0.30	0.19	0.73	0.24
Iron	7439-89-6	16	9	56%	7.7	8.9	39	2.6
Lead	7439-92-1	16	0	0%	0.63	0.23	All ND	0.63
Manganese	7439-96-5	16	13	81%	0.45	0.38	1.5	0.075
Nickel	7440-02-0	16	4	25%	0.082	0.050	0.21	0.065
Selenium	7782-49-2	16	0	0%	1.2	0.46	All ND	1.2
Silver	7440-22-4	16	0	0%	0.12	0.046	All ND	0.12
Sodium	7440-23-5	16	16	100%	18	6.9	27	--
Zinc	7440-66-6	16	4	25%	0.36	0.30	1.3	0.25

Notes:

*Non-detects were evaluated at 1/2 the method detection limit (MDL)

-- = not applicable

MDL = method detection limit

$\mu\text{g}/\text{m}^3$ = micrograms per cubic meter

N = number

ND = non-detect

TABLE 3-1
SOIL AND MINE WASTE COPC SELECTION
Bonita Peak Mining District

Chemical	Summary Statistics						RBC (mg/kg) ^[a]	COPC Selection					
	No. of Samples	No. Detected	Detection Frequency	Mean DL of NDs (mg/kg) ^[b]	Mean Conc. (mg/kg) ^[b]	Max. Conc. (mg/kg) ^[b]		Is Max. Det. Conc. > RBC?	Beneficial Mineral?	DI > RDI (or DRV)?	Is Mean DL of NDs > RBC?	Is Chemical a COPC? (Y/N)	Type of Evaluation
Aluminum	520	520	100%	--	9597	48300	110000	N	N	--	--	N	--
Antimony	513	450	88%	0.18	10	332	47	Y	N	--	--	Y	Quant.
Arsenic	519	518	99.8%	0.07	86	13700	3	Y	N	--	--	Y	Quant.
Barium	484	483	99.8%	0.027	107	1110	22000	N	N	--	--	N	--
Beryllium	519	369	71%	0.35	0.63	9	230	N	N	--	--	N	--
Cadmium	520	476	92%	0.03	6.9	216	98	Y	N	--	--	Y	Quant.
Calcium	520	509	98%	9	3203	86000	No RBC	--	Y	N	--	N	--
Chromium ^[c]	520	516	99.2%	0.77	4.6	16.5	6.3	Y	N	--	--	Y	Quant.
Cobalt	484	481	99%	0.16	8.9	126	35	Y	N	--	--	Y	Quant.
Copper	520	518	99.6%	0.026	256	3830	4700	N	N	--	--	N	--
Iron	520	520	100%	--	37066	317000	82000	Y	N	--	--	Y	Quant.
Lead	520	520	100%	--	2312	44200	800	Y	N	--	--	Y	Quant.
Magnesium	520	520	100%	--	3739	11500	No RBC	--	Y	N	--	N	--
Manganese	519	519	100%	--	4430	96100	2600	Y	N	--	--	Y	Quant.
Mercury	510	475	93%	0.0017	0.22	7.6	35	N	N	--	--	N	--
Molybdenum	350	280	80%	0.099	9.0	159	580	N	N	--	--	N	--
Nickel	520	514	99%	0.38	4.6	66.8	2200	N	N	--	--	N	--
Potassium	67	67	100%	--	1129	2940	No RBC	--	Y	N	--	N	--
Selenium	520	409	79%	0.43	2	32.3	580	N	N	--	--	N	--
Silver	517	460	89%	0.103	8	96.9	580	N	N	--	--	N	--
Sodium	198	76	38%	95.7	99	325	No RBC	--	Y	N	--	N	--
Strontium	98	98	100%	--	33	152	70000	N	N	--	--	N	--
Thallium	512	226	44%	0.24	0.41	6	1.2	Y	N	--	--	Y	Quant.
Vanadium	484	484	100%	--	18	76.1	580	N	N	--	--	N	--
Zinc	520	520	100%	--	1592	66800	35000	Y	N	--	--	Y	Quant.

[a] RBC is based on USEPA Industrial Soil RSL.

[b] Non-detected results were evaluated at 1/2 the MDL.

[c] RBC is based on Chromium (VI).

Notes:

conc. - concentration

COPC - chemical of potential concern

Det. - detect

DI - daily intake

DL - detection limit

DRV - Daily Reference Value

max. - maximum

mg/kg - milligram per kilogram

N - no

ND - non-detect

No. - number

Quant. - quantitative

RBC - risk-based concentration

RDI - Reference Daily Intake

RL - reporting limit

Y - yes

TABLE 3-2
SEDIMENT COPC SELECTION
Bonita Peak Mining District

Chemical	Summary Statistics						RBC (mg/kg) ^[a]	COPC Selection					
	No. of Samples	No. Detected	Detection Frequency	Mean DL of NDs (mg/kg)	Mean Conc. (mg/kg) ^[b]	Max. Conc. (mg/kg)		Is Max. Det. Conc. > RBC?	Beneficial Mineral?	DI > RDI (or DRV)?	Is Mean DL of NDs > RBC?	Is Chemical a COPC? (Y/N)	Type of Evaluation
Aluminum	177	177	100%	--	12831	61600	110000	N	N	--	--	N	--
Antimony	177	129	73%	0.01	2.2	43	47	N	N	--	--	N	--
Arsenic	177	177	100%	--	67	448	3.0	Y	N	--	--	Y	Quant.
Barium	133	133	100%	--	96	267	22000	N	N	--	--	N	--
Beryllium	177	152	86%	0.01	1.7	15	230	N	N	--	--	N	--
Cadmium	177	176	99%	0.003	7.2	268	98	Y	N	--	--	Y	Quant.
Calcium	177	177	100%	--	2946	12100	No RBC	--	Y	N	--	N	--
Chromium ^[c]	177	170	96%	0.1	3.6	37	6.3	Y	N	--	--	Y	Quant.
Cobalt	133	133	100%	--	14	52	35	Y	N	--	--	Y	Quant.
Copper	177	177	100%	--	300	5630	4700	Y	N	--	--	Y	Quant.
Iron	177	177	100%	--	45074	250000	82000	Y	N	--	--	Y	Quant.
Lead	177	177	100%	--	1168	22400	800	Y	N	--	--	Y	Quant.
Magnesium	177	177	100%	--	4217	8010	No RBC	--	Y	N	--	N	--
Manganese	177	177	100%	--	5042	42300	2600	Y	N	--	--	Y	Quant.
Mercury	142	131	92%	0.0003	0.08	1	35	N	N	--	--	N	--
Molybdenum	54	35	65%	0.0	4.1	30	580	N	N	--	--	N	--
Nickel	177	177	100%	--	7.5	46.7	2200	N	N	--	--	N	--
Potassium	139	138	99%	31	987.1	2630	No RBC	--	Y	N	--	N	--
Selenium	176	136	77%	0.1	1.9	174	580	N	N	--	--	N	--
Silver	177	136	77%	0.01	2.7	40.7	580	N	N	--	--	N	--
Sodium	139	37	27%	5	29.22	231.0	No RBC	--	Y	N	--	N	--
Thallium	175	52	30%	0.02	1.16	171	1.2	Y	N	--	--	Y	Quant.
Vanadium	133	133	100%	--	18	45.3	580	N	N	--	--	N	--
Zinc	177	177	100%	--	1749	37300	35000	Y	N	--	--	Y	Quant.

[a] RBC is based on USEPA Industrial Soil RSL.

[b] Non-detected results were evaluated at 1/2 the MDL.

[c] RBC is based on Chromium (VI).

Notes:

conc. - concentration	N - no
COPC - chemical of potential concern	ND - non-detect
Det. - detect	No. - number
DI - daily intake	Quant. - quantitative
DL - detection limit	RBC - risk-based concentration
DRV - Daily Reference Value	RDI - Reference Daily Intake
max. - maximum	RL - reporting limit
mg/kg - milligram per kilogram	Y - yes

TABLE 3-3
SURFACE WATER COPC SELECTION
Bonita Peak Mining District

Chemical	Summary Statistics						RBC (µg/L) ^[a]	COPC Selection					
	No. of Samples	No. Detected	Detection Frequency	Mean DL of NDs (µg/L)	Mean Conc. (µg/L) ^[b]	Max. Conc. (µg/L) ^[b]		Is Max. Det. Conc. > RBC?	Beneficial Mineral?	DI > RDI (or DRV)?	Is Mean DL of NDs > RBC?	Is Chemical a COPC? (Y/N)	Type of Evaluation
Aluminum	432	424	98%	9	741	9350	2000	Y	N	--	--	Y	Quant.
Antimony	387	4	1.0%	1.1	1.2	5.0	0.78	Y	N	--	--	Y	Quant.
Arsenic	429	60	14%	1.2	2	25	0.052	Y	N	--	--	Y	Quant.
Barium	208	50	24%	13	17	78.6	380	N	N	--	--	N	--
Beryllium	429	19	4%	0.9	0.9	4.6	2.5	Y	N	--	--	Y	Quant.
Cadmium	432	329	76%	0.24	1.8	62	0.92	Y	N	--	--	Y	Quant.
Calcium	434	433	100%	50	43020	217000	No RBC	--	Y	N	--	N	--
Chromium ^[c]	432	7	1.6%	2.3	2.3	8.8	0.035	Y	N	--	--	Y	Quant.
Cobalt	208	86	41%	0.25	1.92	29	0.60	Y	N	--	--	Y	Quant.
Copper	432	369	85%	1.2	19	327	80	Y	N	--	--	Y	Quant.
Iron	429	321	75%	46	1312	31100	1400	Y	N	--	--	Y	Quant.
Lead	432	393	91%	0.20	17	778	15	Y	N	--	--	Y	Quant.
Magnesium	434	433	100%	50	3148	17600	No RBC	--	Y	N	--	N	--
Manganese	432	419	97%	1.0	795	33500	43	Y	N	--	--	Y	Quant.
Mercury	5	0	0%	0.05	0	All ND	0.57	--	N	--	N	N	Qual.
Molybdenum	139	17	12%	2.5	3	8.92	10	N	N	--	--	N	--
Nickel	429	67	16%	1.3	2.0	23.1	39	N	N	--	--	N	--
Potassium	253	242	96%	81	531	1860	No RBC	--	Y	N	--	N	--
Selenium	429	2	0.5%	2.3	2.3	5.21	10	N	N	--	--	N	--
Silver	429	3	0.7%	1.1	1.1	0.09	9.4	N	N	--	--	N	--
Sodium	253	252	100%	125	2651	11200	No RBC	--	Y	N	--	N	--
Strontium	221	221	100%	--	436	2100	1200	Y	N	--	--	Y	Quant.
Thallium	429	45	10%	2.0	2.8	28	0.020	Y	N	--	--	Y	Quant.
Vanadium	208	38	18%	5	4.1	3.3	8.6	N	N	--	--	N	--
Zinc	432	429	99%	5	595	13400	600	Y	N	--	--	Y	Quant.

[a] RBC based on USEPA tapwater Regional Screening Level.

[b] Non-detected results were evaluated at 1/2 the MDL.

[c] RBC is based on Chromium (VI).

Notes:

µg/L - micrograms per liter

conc. - concentration

COPC - chemical of potential concern

Det. - detect

DI - daily intake

DL - detection limit

DRV - Daily Reference Value

max. - maximum

N - no

ND - non-detect

No. - number

Qual - retained for qualitative evaluation in the uncertainty assessment

Quant. - quantitative

RBC - risk-based concentration

RDI - Reference Daily Intake

RL - reporting limit

Y - yes

TABLE 3-4
GROUNDWATER COPC SELECTION
Bonita Peak Mining District

Chemical	Summary Statistics					RBC (µg/L) ^[a]	COPC Selection					
	No. of Samples	No. Detected	Detection Frequency	Mean DL of NDs (µg/L)	Max. Conc. (µg/L) ^[b]		Is Max. Det. Conc. > RBC?	Beneficial Mineral?	DI > RDI (or DRV)?	Is Mean DL of NDs > RBC?	Is Chemical a COPC? (Y/N)	Type of Evaluation
Aluminum	2	0	0%	3.0	All ND	2000	--	N	--	N	N	Qual.
Antimony	2	0	0%	0.075	All ND	0.78	--	N	--	N	N	Qual.
Arsenic	2	0	0%	0.075	All ND	0.052	--	N	--	Y	N	Qual.
Barium	1	1	100%	--	40	380	N	N	--	--	N	--
Beryllium	2	0	0%	0.063	All ND	2.5	--	N	--	N	N	Qual.
Cadmium	2	0	0%	0.014	All ND	0.92	--	N	--	N	N	Qual.
Calcium	1	1	100%	--	42300	No RBC	--	Y	N	--	N	--
Chromium ^[c]	2	1	50%	0.25	2.0	0.035	Y	N	--	--	Y	Quant.
Copper	2	2	100%	--	11	80	N	N	--	--	N	--
Iron	2	0	0%	3.8	All ND	1400	--	N	--	N	N	Qual.
Lead	2	1	50%	0.025	0.30	15	N	N	--	--	N	--
Magnesium	1	1	100%	--	3700	No RBC	--	Y	N	--	N	--
Manganese	2	0	0%	0.063	All ND	43	--	N	--	N	N	Qual.
Nickel	2	1	50%	0.13	1.0	39	N	N	--	--	N	--
Potassium	0	--	--	--	--	--	--	Y	--	--	N	--
Selenium	2	0	0%	0.15	All ND	10	--	N	--	N	N	Qual.
Silver	2	1	50%	0.13	0.12	9.4	N	N	--	--	N	--
Sodium	1	1	100%	--	3500	No RBC	--	Y	N	--	N	--
Strontium	1	1	100%	--	370	1200	N	N	--	--	N	--
Zinc	2	2	100%	--	120	600	N	N	--	--	N	--

[a] Screening level based on USEPA tapwater Regional Screening Level.

[b] Non-detected results were evaluated at 1/2 the MDL.

[c] RBC is based on Chromium (VI).

Notes:

µg/L - micrograms per liter

conc. - concentration

COPC - chemical of potential concern

Det. - detect

DI - daily intake

DL - detection limit

DRV - Daily Reference Value

max. - maximum

N - no

ND - non-detect

No. - number

Qual - retained for qualitative evaluation in the uncertainty assessment

Quant. - quantitative

RBC - risk-based concentration

RDI - Reference Daily Intake

RL - reporting limit

Y - yes

TABLE 3-5
COPCS RETAINED FOR QUANTITATIVE EVALUATION
Bonita Peak Mining District

Soil and Mine Waste	Sediment	Surface Water	Groundwater	Air ^a	Fish Tissue ^b	Game Tissue ^c
Antimony	Arsenic	Aluminum	Chromium	Antimony	Aluminum	Antimony
Arsenic	Cadmium	Antimony		Arsenic	Antimony	Arsenic
Cadmium	Chromium	Arsenic		Cadmium	Arsenic	Cadmium
Chromium	Cobalt	Beryllium		Chromium	Beryllium	Chromium
Cobalt	Copper	Cadmium		Cobalt	Cadmium	Cobalt
Iron	Iron	Chromium		Iron	Chromium	Iron
Lead	Lead	Cobalt		Lead	Cobalt	Lead
Manganese	Manganese	Copper		Manganese	Copper	Manganese
Thallium	Thallium	Iron		Thallium	Iron	Mercury
Zinc	Zinc	Lead		Zinc	Lead	Thallium
		Manganese			Manganese	Zinc
		Strontium			Mercury	
		Thallium			Strontium	
		Zinc			Thallium	
					Zinc	

Notes:

[a] List of COPCs is the same as that for soil.

[b] List of COPCs is the same as that for surface water and sediment, with mercury added because it is bioaccumulative.

[c] List of COPCs is the same as that for soil, with mercury added because it is bioaccumulative.

COPC - chemical of potential concern

TABLE 3-6
EVALUATION OF BENEFICIAL MINERALS
Bonita Peak Mining District

Media Type	Essential Nutrient	Maximum Concentration		RME Intake Rate (IR)		Maximum Daily Intake [1] (mg/day)	Accepted Daily Intake [2]		Ratio
		Value	Units	Value	Units		Value	Source	
Surface Water	Calcium	217,000	µg/L	2.5	L/day	543	1,000	RDI	0.5
	Magnesium	17,600	µg/L	2.5	L/day	44	400	RDI	0.1
	Potassium	1,860	µg/L	2.5	L/day	5	3,500	DRV	0.0013
	Sodium	11,200	µg/L	2.5	L/day	28	2,400	DRV	0.012
Groundwater	Calcium	42,300	µg/L	2.5	L/day	106	1,000	RDI	0.1
	Magnesium	3,700	µg/L	2.5	L/day	9	400	RDI	0.02
	Potassium	--	--	--	--	--	--	--	--
	Sodium	3,500	µg/L	2.5	L/day	9	2,400	DRV	0.004
Sediment	Calcium	12,100	mg/kg	100	mg/day	1.2	1,000	RDI	0.001
	Magnesium	8,010	mg/kg	100	mg/day	0.8	400	RDI	0.002
	Potassium	2,630	mg/kg	100	mg/day	0.3	3,500	DRV	0.00008
	Sodium	231	mg/kg	100	mg/day	0.02	2,400	DRV	0.000010
Soil	Calcium	86,000	mg/kg	330	mg/day	28	1,000	RDI	0.03
	Magnesium	11,500	mg/kg	330	mg/day	3.8	400	RDI	0.01
	Potassium	2,940	mg/kg	330	mg/day	1.0	3,500	DRV	0.0003
	Sodium	325	mg/kg	330	mg/day	0.1	2,400	DRV	0.00004

Notes:

[1] Calculated from maximum concentration and RME intake rate for the maximally exposed receptor (highest intake rate).

Max Daily Intake = Cmax * IR. Conversion factors applied (as necessary) to yield daily intake in units of mg/day. Phosphorus in environmental media assumed to be present as phosphate. Maximum site concentration converted to phosphorus by multiplying by 0.316 (mass phosphorus/mass of phosphate).

[2] Values are Reference Daily Intake (RDI) or Daily Reference Value (DRV). RDIs replace the term "U. S. Recommended Daily Allowances" (introduced in 1973 as a reference value for vitamins, minerals, and protein). DRVs are for nutrients for which no set of standards previously existed. Values obtained from <http://www.fda.gov/fdac/special/foodlabel/dvs.html>.

-- - results not available

µg/L - micrograms per liter

L/day - liters per day

mg/day - milligrams per day

mg/kg - milligrams per kilogram

TABLE 4-1
EXPOSURE PARAMETERS FOR ATV GUIDES
Bonita Peak Mining District

Exposure Pathway	Exposure Input Parameter	Units	CTE		RME	
			Adult	Source	Adult	Source
General	Body weight	kg	80	[1]	80	[1]
	Exposure frequency	days/yr	32	[4, a]	48	[5, a]
	Exposure duration	yr	12	[4]	20	[4]
	Averaging Time, Cancer	yr	70	[2]	70	[2]
	Averaging Time, Noncancer	yr	12	[2]	20	[2]
Inhalation of Particulates	Exposure time	hr/day	4	[4, b]	8	[5]
	Riding time factor	unitless	0.5	[6]	0.75	[6]
	Area Use Factor (Alpine Loop)	unitless	0.4	[6]	0.6	[6]
	TWF (noncancer)	unitless	2.9E-03		2.0E-02	
	TWF (cancer)	unitless	5.0E-04		5.6E-03	
Ingestion of Soil	Ingestion rate	mg/day	100	[4, c]	200	[4, c]
	Conversion factor	kg/mg	1E-06	--	1E-06	--
	Area Use Factor (Alpine Loop)	unitless	0.4		0.6	
	HIF (noncancer)	kg/kg-d	4.4E-08		2.0E-07	
	HIF (cancer)	kg/kg-d	7.5E-09		5.6E-08	

Sources:

- [1] USEPA 2014. OSWER Directive 9200.1-120. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure
[2] USEPA 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). Office of Emergency and Remedial Response, Washington, D.C. EPA/540/1-89/002. December.
[3] USEPA 1998. Draft Water Quality Criteria Methodology Revisions.
[4] Professional judgment.
[5] Personal communication with Michael Constantine of Silverton Jeep Trail Tours in Silverton, CO
[6] Site-specific survey of ATV guides.

Notes:

- [a] Assumes exposure occurs over the course of 16 weeks (roughly Memorial Day to Labor Day) at a frequency of 2 day/week for a CTE rider and 3 days/week for an RME rider.
[b] Assumes CTE is one-half of RME.
[c] Assumes soil ingestion rate is twice that of a resident. The ingestion rate for an ATV rider is assumed to include soil that is incidentally ingested from hand-to-mouth activities and soil that is ingested as non-respirable (non-PM10) particles of dust in air.

ATV = all-terrain vehicle

hr = hour

RME = reasonable maximum exposure

CTE = central tendency exposure

kg = kilogram

TWF = time weighting factor

d = day

m³ = cubic meter

yr = year

HIF = human intake factor

mg = milligram

TABLE 4-2
EXPOSURE PARAMETERS FOR ATV RECREATIONAL RIDERS
Bonita Peak Mining District

Exposure Pathway	Exposure Input Parameter	Units	CTE		RME	
			Value	Source	Value	Source
General	Body Weight (older child)	kg	44	[1, a]	44	[1, a]
	Body weight (adult)	kg	80	[2]	80	[2]
	Exposure frequency	days/yr	16	[4, b]	32	[4, b]
	Exposure duration (older child)	yr	6	[4]	10	[2, d]
	Exposure duration (adult)	yr	6	[4]	10	[2, d]
	Averaging Time, Cancer	yr	70	[3]	70	[3]
	Averaging Time, Noncancer	yr	12	[3]	20	[3]
Inhalation of Particulates	Exposure time	hr/day	4	[4]	6	[4]
	Riding time factor	unitless	0.5	[4]	0.75	[4]
	Area Use Factor	unitless	1	[4]	1	[4]
	PEF	kg/m ³	5.6E-07	[5]	5.6E-07	[5]
	TWF (noncancer)	unitless	3.7E-03		1.6E-02	
	TWF (cancer)	unitless	6.3E-04		4.7E-03	
Incidental Ingestion of Soil/Mine Waste	Ingestion rate	mg/day	100	[4, c]	200	[4, c]
	Conversion factor	kg/mg	1E-06	--	1E-06	--
	HIF (noncancer)	kg/kg-d	7.7E-08		3.1E-07	
	HIF (cancer)	kg/kg-d	1.3E-08		8.8E-08	

Sources:

[1] USEPA 2011. Exposure Factors Handbook.

[2] USEPA 2014. OSWER Directive 9200.1-120. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Parameters.

[3] USEPA 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). Office of Emergency and Remedial Response, Washington, D.C. EPA/540/1-89/002. December.

[4] Professional judgment.

[5] See Appendix C for derivation of the PEF.

Notes:

[a] Table 8-1. Age-weighted average based on body weights of children 6-<11 years old and 11-<16 years old.

[b] Assumes exposure occurs over the course of 16 weeks (roughly Memorial Day to Labor Day) at a frequency of 1 day/week for a CTE rider and 2 days/week for an RME rider.

[c] Assumes soil ingestion rate is twice that of a resident. The ingestion rate for an ATV rider is assumed to include soil that is incidentally ingested from hand-to-mouth activities and soil that is ingested as non-respirable (non-PM10) particles of dust in air.

[d] An older child is assumed to be between 6 and 16 years old, an adult is assumed to be 16 years and older.

ATV = all-terrain vehicle

hr = hour

PEF = particulate emission factor

CTE = central tendency exposure

kg = kilogram

RME = reasonable maximum exposure

d = day

m³ = cubic meter

TWF = time weighting factor

HIF = human intake factor

mg = milligram

yr = year

TABLE 4-3
EXPOSURE PARAMETERS FOR HIKERS

Bonita Peak Mining District

Exposure Pathway	Exposure Input Parameter	Units	CTE		RME	
			Value	Source	Value	Source
General	Body Weight (older child)	kg	44	[1, a]	44	[1, a]
	Body weight (adult)	kg	80	[2]	80	[2]
	Exposure frequency	days/yr	32	[4, b]	64	[4, b]
	Exposure duration (older child)	yr	6	[4]	10	[2, e]
	Exposure duration (adult)	yr	6	[4]	10	[2, e]
	Averaging Time, Cancer	yr	70	[3]	70	[3]
	Averaging Time, Noncancer	yr	12	[3]	20	[3]
Incidental Ingestion of Soil/Mine Waste	Ingestion rate	mg/day	50	[4, c]	100	[4, d]
	Conversion factor	kg/mg	1E-06	--	1E-06	--
	HIF (noncancer)	kg/kg-d	7.7E-08		3.1E-07	
	HIF (cancer)	kg/kg-d	1.3E-08		8.8E-08	

Sources:

[1] USEPA 2011. Exposure Factors Handbook.

[2] USEPA 2014. OSWER Directive 9200.1-120. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Parameters.

[3] USEPA 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). Office of Emergency and Remedial Response, Washington, D.C. EPA/540/1-89/002. December.

[4] Professional judgment.

Notes:

[a] Table 8-1. Age-weighted average based on body weights of children 6-<11 years old and 11-<16 years old.

[b] Assumes exposure occurs over the course of 16 weeks (roughly Memorial Day to Labor Day) at a frequency of 2 days/week for a CTE visitor and 4 days/week for an RME visitor.

[c] CTE exposure frequency assumed to be half that of the RME receptor.

[d] Assumes soil ingestion by a hiker is similar to that of a resident.

[e] An older child is assumed to be between 6 and 16 years old, an adult is assumed to be 16 years and older.

CTE = central tendency exposure

kg = kilogram

TWF = time weighting factor

d = day

m³ = cubic meter

yr = year

HIF = human intake factor

mg = milligram

hr = hour

RME = reasonable maximum exposure

TABLE 4-4
EXPOSURE PARAMETERS FOR RECREATIONAL FISHERMAN

Bonita Peak Mining District

Exposure Pathway	Exposure Input Parameter	Units	CTE		RME	
			Value	Source	Value	Source
General	Body Weight (older child)	kg	44	[3, a]	44	[3, a]
	Body weight (adult)	kg	80	[1]	80	[1]
	Exposure frequency	days/yr	30	[4]	60	[4]
	Exposure duration (older child)	yr	6	[4]	10	[1, i]
	Exposure duration (adult)	yr	6	[4]	10	[1, i]
	Averaging Time, Cancer	yr	70	[2]	70	[2]
	Averaging Time, Noncancer	yr	12	[2]	20	[2]
Incidental Ingestion of Sediment	Ingestion rate	mg/day	50	[4, b]	100	[4, b]
	Conversion factor	kg/mg	1E-06		1E-06	
	HIF (noncancer)	kg/kg-d	7.2E-08		2.9E-07	
	HIF (cancer)	kg/kg-d	1.2E-08		8.3E-08	
Incidental Ingestion of Surface Water	Ingestion rate	mL/day	2.1	[3, f, g]	7.1	[3, f, g]
	Conversion factor	L/mL	1E-03		1E-03	
	HIF (noncancer)	L/kg-d	3.0E-06		2.1E-05	
	HIF (cancer)	L/kg-d	5.2E-07		5.9E-06	
Ingestion of Fish	Ingestion rate (total)	g/day	12	[3, c]	43	[3, c]
	Exposure frequency	days/yr	350	[5, h]	350	[5, h]
	Conversion factor	kg/g	1E-03		1E-03	
	Fraction from Site	unitless	0.1	[4, d]	0.2	[4, d]
	HIF (noncancer)	kg/kg-d	2.0E-05		1.5E-04	
	HIF (cancer)	kg/kg-d	3.5E-06		4.2E-05	

Sources:

[1] USEPA 2014. OSWER Directive 9200.1-120. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Parameters.

[2] USEPA 1989. Risk Assessment Guidance for Superfund, Volume I, Part A.

[3] USEPA 2011. Exposure Factors Handbook.

[4] Professional judgement.

[5] USEPA 1991. Standard Default Exposure Factors. OSWER Directive 9285.6-03.

Notes:

[a] Table 8-1. Age-weighted average based on body weights of children 6-<11 years old and 11-<16 years old.

[b] Assumes sediment ingestion is similar to that of a resident. CTE exposure assumed to be half that of an RME receptor.

[c] Based on long-term average mean and 95th percentile ingestion rates presented in EFH Table 10-5 for freshwater recreational fish intake by consuming anglers in North Dakota (nearest state to Colorado with data).

[d] Assumes 10% and 20% of fish consumed annually are from the drainage areas impacted by the Site.

[e] Per USEPA (1989), long-term average intake rates are to be applied at an exposure frequency of 365 days/year.

[f] Incidental ingestion from splashing or hand-to-face contact during wading assumed to be 10% of USEPA (1989) recommended default incidentally ingested during swimming.

[g] Table 3-5, USEPA 2011.

[h] Assumed to be equal to the residential default exposure frequency.

[i] An older child is assumed to be between 6 and 16 years old, an adult is assumed to be 16 years and older.

CTE = Central Tendency Exposure kg = kilogram

mL = milliliter

d = day

L = liter

RME = Reasonable Maximum Exposure

g = gram

mg = milligram

yr = year

HIF = Human Intake Factor

TABLE 4-5
EXPOSURE PARAMETERS FOR ADULT CAMPERS (USFS CAMPGROUND)
Bonita Peak Mining District

Exposure Pathway	Exposure Input Parameter	Units	CTE		RME	
			Value	Source	Value	Source
General	Body weight (older child)	kg	44	[3, a]	44	[3, a]
	Body weight (adult)	kg	80	[4]	80	[4]
	Exposure frequency	days/yr	7	[5, b]	14	[7, b]
	Exposure duration (older child)	yr	6	[6]	10	[4, g]
	Exposure duration (adult)	yr	6	[6]	10	[4, g]
	Averaging Time, Cancer	yr	70	[2]	70	[2]
	Averaging Time, Noncancer	yr	12	[2]	20	[2]
Incidental Ingestion of Soil/Mine Waste	Ingestion rate	mg/day	100	[5, d]	200	[5, d]
	Conversion factor	kg/mg	1E-06		1E-06	
	HIF (noncancer)	kg/kg-d	3.4E-08		1.4E-07	
	HIF (cancer)	kg/kg-d	5.8E-09		3.9E-08	
Incidental Ingestion of Sediment	Ingestion rate	mg/day	50	[5, c]	100	[5]
	Conversion factor	kg/mg	1E-06		1E-06	
	HIF (noncancer)	kg/kg-d	1.7E-08		6.8E-08	
	HIF (cancer)	kg/kg-d	2.9E-09		1.9E-08	
Incidental Ingestion of Surface Water	Ingestion rate	mL/hr	2.1	[3, e, f]	7.1	[3, e, f]
	Exposure time	hr/d	0.5	[5]	1.5	[5]
	Conversion factor	L/mL	1E-03		1E-03	
	HIF (noncancer)	L/kg-d	3.5E-07		7.2E-06	
	HIF (cancer)	L/kg-d	6.1E-08		2.1E-06	
Ingestion of Groundwater (as drinking water)	Ingestion rate	L/day	1.4	[1, 2]	2.5	[4]
	HIF (noncancer)	L/kg-d	4.7E-04		1.7E-03	
	HIF (cancer)	L/kg-d	8.1E-05		4.8E-04	

Sources:

- [1] USEPA 1991. Standard Default Exposure Factors. OSWER Directive 9285.6-03.
- [2] USEPA 1989. Risk Assessment Guidance for Superfund, Volume I, Part A.
- [3] USEPA 2011. Exposure Factors Handbook.
- [4] USEPA 2014. OSWER Directive 9200.1-120. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Parameters.
- [5] Professional judgement.
- [6] USEPA 1993. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.
- [7] USFS. Guidelines for the San Juan National Forest. <https://www.fs.usda.gov/activity/sanjuan/recreation/camping-cabins/?recid=42728&actid=34>

Notes:

- [a] Table 8-1. Age-weighted average based on body weights of children 6-<11 years old and 11-<16 years old.
- [b] Assumes exposure for an RME visitor is limited to 14 days/year per Source 7 and a CTE visitor's exposure is half of the RME visitor (i.e., 7 days).
- [c] Assumes CTE value is half of the RME value.
- [d] Assumes RME soil ingestion by a camper is twice that of a resident.
- [e] Incidental ingestion from splashing or hand-to-face contact during wading assumed to be 10% of USEPA (1989) recommended default incidentally ingested during swimming.
- [f] Table 3-5, USEPA 2011.
- [g] An older child is assumed to be between 6 and 16 years old, an adult is assumed to be 16 years and older.

CTE = central tendency exposure	kg = kilogram	RME = reasonable maximum exposure
d = day	L = liter	USFS = United States Forest Service
HIF = human intake factor	mg = milligram	yr = year
hr = hour	mL = milliliter	

TABLE 4-7
EXPOSURE PARAMETERS FOR CHILD CAMPERS (USFS CAMPGROUND AND DISPERSED CAMPING)
Bonita Peak Mining District

Exposure Pathway	Exposure Input Parameter	Units	CTE		RME	
			Value	Source	Value	Source
General	Body weight	kg	15	[2]	15	[2]
	Exposure frequency	days/yr	7	[3, f]	14	[3, f]
	Exposure duration	yr	2	[3]	6	[3]
	Averaging Time, Cancer	yr	70	[1]	70	[1]
	Averaging Time, Noncancer	yr	2	[1]	6	[1]
Incidental Ingestion of Soil/Mine Waste	Ingestion rate	mg/day	203	[6, b]	429	[6, b]
	Conversion factor	kg/mg	1E-06		1E-06	
	HIF (noncancer)	kg/kg-d	2.6E-07		1.1E-06	
	HIF (cancer)	kg/kg-d	7.4E-09		9.4E-08	
Incidental Ingestion of Surface Water	Ingestion rate	mL/hr	4.9	[5, d, e]	12	[5, d, e]
	Exposure time	hr/d	0.5	[3]	1.5	[3]
	Conversion factor	L/mL	1E-03		1E-03	
	HIF (noncancer)	L/kg-d	3.1E-06		4.6E-05	
	HIF (cancer)	L/kg-d	8.9E-08		3.9E-06	
Incidental Ingestion of Sediment	Ingestion rate	mg/day	50	[3, a]	100	[3, a]
	Conversion factor	kg/mg	1E-06		1E-06	
	HIF (noncancer)	kg/kg-d	6.4E-08		2.6E-07	
	HIF (cancer)	kg/kg-d	1.8E-09		2.2E-08	
Ingestion of Water (surface water for dispersed camper, ground water for USFS camper)	Ingestion rate	L/day	0.5	[1, c]	0.78	[4]
	HIF (noncancer)	L/kg-d	6.4E-04		2.0E-03	
	HIF (cancer)	L/kg-d	1.8E-05		1.7E-04	

Sources:

- [1] USEPA 1989. Risk Assessment Guidance for Superfund, Volume I, Part A.
- [2] USEPA 1991. Standard Default Exposure Factors. OSWER Directive 9285.6-03.
- [3] Professional judgement.
- [4] USEPA 2014. OSWER Directive 9200.1-120. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Parameters.
- [5] USEPA 2011. Exposure Factors Handbook.
- [6] USEPA. 2008. Child-Specific Exposure Factors Handbook.

Notes:

- [a] Assumes sediment ingestion is similar to that of a resident. CTE exposure assumed to be half that of an RME receptor.
- [b] Assumes RME soil ingestion is represented by the 95th percentile of all girls and boys ages zero to five years old. Assumes CTE soil ingestion is represented by the mean of all girls and boys ages zero to six years old. The average value for age 5-6 years old was assumed to be equal to the average for ages 4-5 years old.
- [c] Assumes water intake by camper is similar to a resident
- [d] Incidental ingestion from splashing or hand-to-face contact during wading assumed to be 10% of USEPA (1989) recommended default incidentally ingested during swimming.
- [e] Table 3-5, USEPA 2011.
- [f] Assumes exposure for an RME visitor is limited to 14 days/year and a CTE visitor's exposure is half of the RME visitor (i.e., 7 days).

CTE = central tendency exposure kg = kilogram RME = reasonable maximum exposure
d = day L = liter yr = year
HIF = human intake factor mg = milligram
hr = hour mL = milliliter

TABLE 4-8
EXPOSURE PARAMETERS FOR HUNTERS
Bonita Peak Mining District

Exposure Pathway	Exposure Input Parameter	Units	CTE		RME	
			Value	Source	Value	Source
General	Body weight (older child)	kg	44	[4, c]	44	[4, c]
	Body weight (adult)	kg	80	[1]	80	[1]
	Exposure frequency	days/yr	10	[3, a]	20	[3, a]
	Exposure duration (older child)	yr	6	[3]	10	[1, f]
	Exposure duration (adult)	yr	6	[3]	10	[1, f]
	Averaging Time, Cancer	yr	70	[2]	70	[2]
	Averaging Time, Noncancer	yr	12	[2]	20	[2]
Incidental Ingestion of Soil/Mine Waste	Ingestion rate	mg/day	50	[3, a]	100	[3, a]
	Conversion factor	kg/mg	1E-06	--	1E-06	--
	HIF (noncancer)	kg/kg-d	2.4E-08		9.7E-08	
	HIF (cancer)	kg/kg-d	4.1E-09		2.8E-08	
Ingestion of Large Game (Deer)	Ingestion rate	meals/wk	1	[3, a]	2	[3, a]
	Conversion factor	wk/d	0.14		0.14	
	Meal weight	kg/meal	0.114	[3, b]	0.227	[3, b]
	Fraction from Site	unitless	1	[3]	1	[3]
	Exposure Frequency	days/yr	350	[5, e]	350	[5, e]
	HIF (noncancer)	kg/kg-d	2.7E-04		1.1E-03	
	HIF (cancer)	kg/kg-d	4.7E-05		3.1E-04	
Ingestion of Terrestrial Birds (Grouse)	Ingestion rate	meals/wk	0.25	[3, a]	0.5	[3, a]
	Conversion factor	wk/d	0.14		0.14	
	Meal weight	kg/meal	0.057	[3, b]	0.11	[3, b]
	Fraction from Site	unitless	1	[3]	1	[3]
	Exposure Frequency	days/yr	350	[5, e]	350	[5, e]
	HIF (noncancer)	kg/kg-d	3.4E-05		1.4E-04	
	HIF (cancer)	kg/kg-d	5.9E-06		3.9E-05	

Sources:

- [1] USEPA 2014. OSWER Directive 9200.1-120. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Parameters.
- [2] USEPA 1989. Risk Assessment Guidance for Superfund, Volume I, Part A.
- [3] Professional judgement.
- [4] USEPA 2011. Exposure Factors Handbook.
- [5] USEPA 1991. Standard Default Exposure Factors. OSWER Directive 9285.6-03.

Notes:

- [a] Assumed value.
- [b] Assumes 0.25 pound/meal for CTE value and 0.5 pound/meal for RME value for the deer. Assumes grouse portions are half that of deer.
- [c] Table 8-1. Age-weighted average based on body weights of children 6-<11 years old and 11-<16 years old.
- [d] Per USEPA (1989), long-term average intake rates are to be applied at an exposure frequency of 365 days/year.
- [e] Assumed to be equal to the residential default exposure frequency.
- [f] An older child is assumed to be between 6 and 16 years old, an adult is assumed to be 16 years and older.

CTE = central tendency exposure kg = kilogram wk = week
d = day mg = milligram yr = year
HIF = human intake factor RME = reasonable maximum exposure

**TABLE 4-9
EXPOSURE PARAMETERS FOR ROADWAY WORKERS**

Bonita Peak Mining District

Exposure Pathway	Exposure Input Parameter	Units	CTE		RME	
			Value	Source	Value	Source
General	Body weight (adult)	kg	80	[2]	80	[2]
	Exposure frequency	days/yr	100	[4, a]	100	[4, a]
	Exposure duration	yr	5	[4]	10	[4]
	Averaging Time, Cancer	yr	70	[3]	70	[3]
	Averaging Time, Noncancer	yr	5	[3]	10	[3]
Inhalation of Particulates	Exposure time	hr/day	6	[4]	8	[2]
	TWF (noncancer)	unitless	6.8E-02		9.1E-02	
	TWF (cancer)	unitless	4.9E-03		1.3E-02	
Incidental Ingestion of Soil	Ingestion rate	mg/day	165	[4, b]	330	[1]
	Conversion factor	kg/mg	1E-06	--	1E-06	--
	HIF (noncancer)	kg/kg-d	5.7E-07		1.1E-06	
	HIF (cancer)	kg/kg-d	4.0E-08		1.6E-07	

Sources:

[1] USEPA 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

[2] USEPA 2014. OSWER Directive 9200.1-120. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Parameters.

[3] USEPA 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). Office of Emergency and Remedial Response, Washington, D.C. EPA/540/1-89/002. December.

[4] Professional judgment.

Notes:

[a] Assumes exposure occurs over the course of 20 weeks when roads may not be covered with snow for 5 days/week.

[b] Assumes soil ingestion rate for a CTE receptor is half that of the RME receptor.

CTE = central tendency exposure

HIF = human intake factor

hr = hour

kg = kilogram

mg = milligram

RME = reasonable maximum exposure

TWF = time weighting factor

yr = year

TABLE 4-10
EXPOSURE POINT CONCENTRATIONS
 Bonita Peak Mining District

Receptor	Exposure Unit	Media Type	Chemical Name	Exposure Point Concentration (EPC)	
				Value	Comments
ATV Guide	EU5a	Soil	Antimony	2.445	95% Chebyshev (Mean, Sd) UCL
ATV Guide	EU5a	Soil	Arsenic	24.72	95% Adjusted Gamma UCL
ATV Guide	EU5a	Soil	Cadmium	1.846	95% Adjusted Gamma UCL
ATV Guide	EU5a	Soil	Chromium	5.329	95% Student's-t UCL
ATV Guide	EU5a	Soil	Chromium(III)	4.8	calculated using assumed 90:10 ratio (chromium III: chromium VI)
ATV Guide	EU5a	Soil	Chromium(VI)	0.53	calculated using assumed 90:10 ratio (chromium III: chromium VI)
ATV Guide	EU5a	Soil	Cobalt	6.544	95% Student's-t UCL
ATV Guide	EU5a	Soil	Iron	36313	95% Student's-t UCL
ATV Guide	EU5a	Soil	Manganese	1571	95% H-UCL
ATV Guide	EU5a	Soil	Thallium	0.19	KM H-UCL
ATV Guide	EU5a	Soil	Zinc	751.5	95% Chebyshev (Mean, Sd) UCL
ATV Rec	EU5b	Soil	Antimony	16.03	95% KM (Chebyshev) UCL
ATV Rec	EU5b	Soil	Arsenic	46.92	95% Approximate Gamma UCL
ATV Rec	EU5b	Soil	Cadmium	5.12	95% H-UCL
ATV Rec	EU5b	Soil	Chromium	5.139	95% Approximate Gamma UCL
ATV Rec	EU5b	Soil	Chromium(III)	4.6	calculated using assumed 90:10 ratio (chromium III: chromium VI)
ATV Rec	EU5b	Soil	Chromium(VI)	0.51	calculated using assumed 90:10 ratio (chromium III: chromium VI)
ATV Rec	EU5b	Soil	Cobalt	8.551	95% H-UCL
ATV Rec	EU5b	Soil	Iron	31787	95% Student's-t UCL
ATV Rec	EU5b	Soil	Manganese	4429	95% Chebyshev (Mean, Sd) UCL
ATV Rec	EU5b	Soil	Thallium	0.614	95% KM (Chebyshev) UCL
ATV Rec	EU5b	Soil	Zinc	1056	95% H-UCL
Camper - Campground	EU6	Groundwater	Chromium	0.002	Low detection frequency; value shown is the maximum detected concentration.
Camper - Campground	EU6	Groundwater	Chromium(III)	0.0018	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Camper - Campground	EU6	Groundwater	Chromium(VI)	0.00	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Camper - Campground	EU6	Sediment	Arsenic	28.1	95% Student's-t UCL
Camper - Campground	EU6	Sediment	Cadmium	3.617	95% Student's-t UCL
Camper - Campground	EU6	Sediment	Chromium	3.474	UCL exceeded maximum conc; value shown is UCL. 95% Student's-t UCL
Camper - Campground	EU6	Sediment	Chromium(III)	3.1266	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Camper - Campground	EU6	Sediment	Chromium(VI)	0.3474	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Camper - Campground	EU6	Sediment	Cobalt	34.12	UCL exceeded maximum conc; value shown is UCL. 95% Student's-t UCL
Camper - Campground	EU6	Sediment	Copper	24.67	UCL exceeded maximum conc; value shown is UCL. 95% Student's-t UCL
Camper - Campground	EU6	Sediment	Iron	33017	95% Student's-t UCL
Camper - Campground	EU6	Sediment	Manganese	2879	UCL exceeded maximum conc; value shown is UCL. 95% Student's-t UCL
Camper - Campground	EU6	Sediment	Zinc	1017	95% Student's-t UCL
Camper - Campground	EU6	Sediment	Thallium	--	All non-detect
Camper - Campground	EU6	Soil	Antimony	0.8	One sample collected; value shown is the maximum detected concentration.
Camper - Campground	EU6	Soil	Arsenic	18.7	One sample collected; value shown is the maximum detected concentration.
Camper - Campground	EU6	Soil	Cadmium	1.1	One sample collected; value shown is the maximum detected concentration.
Camper - Campground	EU6	Soil	Chromium	4.8	One sample collected; value shown is the maximum detected concentration.
Camper - Campground	EU6	Soil	Chromium(III)	4.3	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Camper - Campground	EU6	Soil	Chromium(VI)	0.48	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Camper - Campground	EU6	Soil	Cobalt	9.4	One sample collected; value shown is the maximum detected concentration.
Camper - Campground	EU6	Soil	Iron	22100	One sample collected; value shown is the maximum detected concentration.
Camper - Campground	EU6	Soil	Manganese	1400	One sample collected; value shown is the maximum detected concentration.
Camper - Campground	EU6	Soil	Thallium	0.099	One sample collected; value shown is the maximum detected concentration.
Camper - Campground	EU6	Soil	Zinc	270	One sample collected; value shown is the maximum detected concentration.
Camper - Campground	EU6	Surface Water	Aluminum	0.8799	95% Student's-t UCL
Camper - Campground	EU6	Surface Water	Antimony	--	All non-detect
Camper - Campground	EU6	Surface Water	Arsenic	0.00013	Low detection frequency; value shown is the maximum detected concentration.
Camper - Campground	EU6	Surface Water	Beryllium	--	All non-detect
Camper - Campground	EU6	Surface Water	Cadmium	0.00024	Low detection frequency; value shown is the maximum detected concentration.
Camper - Campground	EU6	Surface Water	Chromium	--	All non-detect
Camper - Campground	EU6	Surface Water	Chromium(III)	--	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Camper - Campground	EU6	Surface Water	Chromium(VI)	--	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Camper - Campground	EU6	Surface Water	Cobalt	0.97	Only one sample
Camper - Campground	EU6	Surface Water	Copper	--	All non-detect
Camper - Campground	EU6	Surface Water	Iron	0.1764	95% KM (t) UCL
Camper - Campground	EU6	Surface Water	Manganese	0.1375	95% Student's-t UCL
Camper - Campground	EU6	Surface Water	Strontium	0.1944	95% Student's-t UCL
Camper - Campground	EU6	Surface Water	Thallium	0.00853	Low detection frequency; value shown is the maximum detected concentration.
Camper - Campground	EU6	Surface Water	Zinc	0.06052	95% Student's-t UCL
Camper - Dispersed	EU7	Sediment	Arsenic	32.33	95% Adjusted Gamma UCL
Camper - Dispersed	EU7	Sediment	Cadmium	41.16	95% KM (Chebyshev) UCL
Camper - Dispersed	EU7	Sediment	Chromium	4.063	95% KM (t) UCL
Camper - Dispersed	EU7	Sediment	Chromium(III)	3.7	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Camper - Dispersed	EU7	Sediment	Chromium(VI)	0.41	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Camper - Dispersed	EU7	Sediment	Cobalt	12.35	95% Student's-t UCL
Camper - Dispersed	EU7	Sediment	Copper	933.1	95% Chebyshev (Mean, Sd) UCL
Camper - Dispersed	EU7	Sediment	Iron	70145	95% Chebyshev (Mean, Sd) UCL
Camper - Dispersed	EU7	Sediment	Manganese	7951	95% Adjusted Gamma UCL
Camper - Dispersed	EU7	Sediment	Thallium	0.172	95% KM Adjusted Gamma UCL
Camper - Dispersed	EU7	Sediment	Zinc	3207	95% H-UCL

TABLE 4-10
EXPOSURE POINT CONCENTRATIONS
 Bonita Peak Mining District

Receptor	Exposure Unit	Media Type	Chemical Name	Exposure Point Concentration (EPC)	
				Value	Comments
Camper - Dispersed	EU7	Soil	Antimony	50.77	97.5% KM (Chebyshev) UCL
Camper - Dispersed	EU7	Soil	Arsenic	44.86	95% Student's-t UCL
Camper - Dispersed	EU7	Soil	Cadmium	14.42	95% Adjusted Gamma UCL
Camper - Dispersed	EU7	Soil	Chromium	7.369	95% Student's-t UCL
Camper - Dispersed	EU7	Soil	Chromium(III)	6.6	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Camper - Dispersed	EU7	Soil	Chromium(VI)	0.74	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Camper - Dispersed	EU7	Soil	Cobalt	12.66	95% Adjusted Gamma UCL
Camper - Dispersed	EU7	Soil	Iron	34108	95% Student's-t UCL
Camper - Dispersed	EU7	Soil	Manganese	3290	95% Adjusted Gamma UCL
Camper - Dispersed	EU7	Soil	Thallium	0.342	95% KM Adjusted Gamma UCL
Camper - Dispersed	EU7	Soil	Zinc	2213	95% Adjusted Gamma UCL
Camper - Dispersed	EU7	Surface Water	Aluminum	1.156	95% KM (Chebyshev) UCL
Camper - Dispersed	EU7	Surface Water	Antimony	0.00504	Low detection frequency; value shown is the maximum detected concentration.
Camper - Dispersed	EU7	Surface Water	Arsenic	0.000767	95% KM (t) UCL
Camper - Dispersed	EU7	Surface Water	Beryllium	0.00463	Low detection frequency; value shown is the maximum detected concentration.
Camper - Dispersed	EU7	Surface Water	Cadmium	0.00483	95% KM (Chebyshev) UCL
Camper - Dispersed	EU7	Surface Water	Chromium	0.00876	Low detection frequency; value shown is the maximum detected concentration.
Camper - Dispersed	EU7	Surface Water	Chromium(III)	0.0079	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Camper - Dispersed	EU7	Surface Water	Chromium(VI)	0.00	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Camper - Dispersed	EU7	Surface Water	Cobalt	0.003063	95% KM Approximate Gamma UCL
Camper - Dispersed	EU7	Surface Water	Copper	0.03008	95% KM (Chebyshev) UCL
Camper - Dispersed	EU7	Surface Water	Iron	3.093	95% KM (Chebyshev) UCL
Camper - Dispersed	EU7	Surface Water	Manganese	0.8432	95% KM (Chebyshev) UCL
Camper - Dispersed	EU7	Surface Water	Strontium	0.4923	95% Approximate Gamma UCL
Camper - Dispersed	EU7	Surface Water	Thallium	0.001361	KM Student's t
Camper - Dispersed	EU7	Surface Water	Zinc	1.184	95% KM (Chebyshev) UCL
Hiker	EU1	Soil-Overbank	Antimony	3.983	95% KM (t) UCL
Hiker	EU1	Soil-Overbank	Arsenic	76.16	95% Adjusted Gamma UCL
Hiker	EU1	Soil-Overbank	Cadmium	25.94	KM H-UCL
Hiker	EU1	Soil-Overbank	Chromium	5.421	95% Student's-t UCL
Hiker	EU1	Soil-Overbank	Chromium(III)	4.9	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hiker	EU1	Soil-Overbank	Chromium(VI)	0.54	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hiker	EU1	Soil-Overbank	Cobalt	18.01	95% Adjusted Gamma UCL
Hiker	EU1	Soil-Overbank	Iron	37002	95% Modified-t UCL
Hiker	EU1	Soil-Overbank	Manganese	10872	95% Adjusted Gamma UCL
Hiker	EU1	Soil-Overbank	Thallium	0.654	95% KM (t) UCL
Hiker	EU1	Soil-Overbank	Zinc	1999	95% H-UCL
Hiker	EU1	Soil-Waste Rock	Antimony	115.8	95% Adjusted Gamma UCL
Hiker	EU1	Soil-Waste Rock	Arsenic	271	95% H-UCL
Hiker	EU1	Soil-Waste Rock	Cadmium	25.06	95% Adjusted Gamma UCL
Hiker	EU1	Soil-Waste Rock	Chromium	2.98	95% Adjusted Gamma UCL
Hiker	EU1	Soil-Waste Rock	Chromium(III)	2.7	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hiker	EU1	Soil-Waste Rock	Chromium(VI)	0.30	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hiker	EU1	Soil-Waste Rock	Cobalt	10.8	95% H-UCL
Hiker	EU1	Soil-Waste Rock	Iron	41105	95% Student's-t UCL
Hiker	EU1	Soil-Waste Rock	Manganese	2480	95% Adjusted Gamma UCL
Hiker	EU1	Soil-Waste Rock	Thallium	2.518	95% KM Adjusted Gamma UCL
Hiker	EU1	Soil-Waste Rock	Zinc	7017	95% Adjusted Gamma UCL
Hiker	EU2	Soil-Overbank	Antimony	27.29	KM H-UCL
Hiker	EU2	Soil-Overbank	Arsenic	40.23	95% H-UCL
Hiker	EU2	Soil-Overbank	Cadmium	8.822	95% KM Adjusted Gamma UCL
Hiker	EU2	Soil-Overbank	Chromium	5.794	95% Student's-t UCL
Hiker	EU2	Soil-Overbank	Chromium(III)	5.2	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hiker	EU2	Soil-Overbank	Chromium(VI)	0.58	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hiker	EU2	Soil-Overbank	Cobalt	13.16	95% Student's-t UCL
Hiker	EU2	Soil-Overbank	Iron	40511	95% Student's-t UCL
Hiker	EU2	Soil-Overbank	Manganese	11796	95% Chebyshev (Mean, Sd) UCL
Hiker	EU2	Soil-Overbank	Thallium	0.428	95% KM (t) UCL
Hiker	EU2	Soil-Overbank	Zinc	2443	95% H-UCL
Hiker	EU2	Soil-Waste Rock	Antimony	19.4	95% KM Approximate Gamma UCL
Hiker	EU2	Soil-Waste Rock	Arsenic	48.35	95% Chebyshev (Mean, Sd) UCL
Hiker	EU2	Soil-Waste Rock	Cadmium	23.27	95% Chebyshev (Mean, Sd) UCL
Hiker	EU2	Soil-Waste Rock	Chromium	5.139	95% KM (t) UCL
Hiker	EU2	Soil-Waste Rock	Chromium(III)	4.6	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hiker	EU2	Soil-Waste Rock	Chromium(VI)	0.51	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hiker	EU2	Soil-Waste Rock	Cobalt	10.56	95% KM (t) UCL
Hiker	EU2	Soil-Waste Rock	Iron	30533	95% Student's-t UCL
Hiker	EU2	Soil-Waste Rock	Manganese	25324	95% Chebyshev (Mean, Sd) UCL
Hiker	EU2	Soil-Waste Rock	Thallium	0.308	95% KM Approximate Gamma UCL
Hiker	EU2	Soil-Waste Rock	Zinc	5180	95% Chebyshev (Mean, Sd) UCL

TABLE 4-10
EXPOSURE POINT CONCENTRATIONS
 Bonita Peak Mining District

Receptor	Exposure Unit	Media Type	Chemical Name	Exposure Point Concentration (EPC)	
				Value	Comments
Hiker	EU3	Soil-Overbank	Antimony	2.757	95% Approximate Gamma UCL
Hiker	EU3	Soil-Overbank	Arsenic	41.45	95% Student's-t UCL
Hiker	EU3	Soil-Overbank	Cadmium	7.297	KM H-UCL
Hiker	EU3	Soil-Overbank	Chromium	5.572	95% Chebyshev (Mean, Sd) UCL
Hiker	EU3	Soil-Overbank	Chromium(III)	5.0	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hiker	EU3	Soil-Overbank	Chromium(VI)	0.56	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hiker	EU3	Soil-Overbank	Cobalt	9.078	95% KM Approximate Gamma UCL
Hiker	EU3	Soil-Overbank	Iron	55155	95% Modified-t UCL
Hiker	EU3	Soil-Overbank	Manganese	2836	95% H-UCL
Hiker	EU3	Soil-Overbank	Thallium	1	Low detection frequency; value shown is the maximum detected concentration.
Hiker	EU3	Soil-Overbank	Zinc	1133	95% Chebyshev (Mean, Sd) UCL
Hiker	EU3	Soil-Waste Rock	Antimony	45.02	95% Adjusted Gamma UCL
Hiker	EU3	Soil-Waste Rock	Arsenic	106.6	95% Student's-t UCL
Hiker	EU3	Soil-Waste Rock	Cadmium	13.78	95% Adjusted Gamma UCL
Hiker	EU3	Soil-Waste Rock	Chromium	4.279	95% Student's-t UCL
Hiker	EU3	Soil-Waste Rock	Chromium(III)	3.9	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hiker	EU3	Soil-Waste Rock	Chromium(VI)	0.43	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hiker	EU3	Soil-Waste Rock	Cobalt	9.959	95% Adjusted Gamma UCL
Hiker	EU3	Soil-Waste Rock	Iron	83648	95% H-UCL
Hiker	EU3	Soil-Waste Rock	Manganese	1287	95% H-UCL
Hiker	EU3	Soil-Waste Rock	Thallium	0.421	95% Student's-t UCL
Hiker	EU3	Soil-Waste Rock	Zinc	9608	95% Adjusted Gamma UCL
Hiker	EU4	Soil-Overbank	Antimony	2.53	KM H-UCL
Hiker	EU4	Soil-Overbank	Arsenic	56.24	KM H-UCL
Hiker	EU4	Soil-Overbank	Cadmium	2.925	KM H-UCL
Hiker	EU4	Soil-Overbank	Chromium	4.743	95% Approximate Gamma UCL
Hiker	EU4	Soil-Overbank	Chromium(III)	4.3	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hiker	EU4	Soil-Overbank	Chromium(VI)	0.47	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hiker	EU4	Soil-Overbank	Cobalt	15.65	95% H-UCL
Hiker	EU4	Soil-Overbank	Iron	61544	95% H-UCL
Hiker	EU4	Soil-Overbank	Manganese	1986	95% H-UCL
Hiker	EU4	Soil-Overbank	Thallium	0.125	95% KM (Chebyshev) UCL
Hiker	EU4	Soil-Overbank	Zinc	458.1	95% H-UCL
Hiker	EU4	Soil-Waste Rock	Antimony	77.26	95% Adjusted Gamma UCL
Hiker	EU4	Soil-Waste Rock	Arsenic	10393	99% Chebyshev (Mean, Sd) UCL
Hiker	EU4	Soil-Waste Rock	Cadmium	170.7	UCL exceeded maximum conc; value shown is UCL. 99% KM (Chebyshev) UCL
Hiker	EU4	Soil-Waste Rock	Chromium	7.438	95% Adjusted Gamma UCL
Hiker	EU4	Soil-Waste Rock	Chromium(III)	6.7	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hiker	EU4	Soil-Waste Rock	Chromium(VI)	0.74	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hiker	EU4	Soil-Waste Rock	Cobalt	45.95	95% Chebyshev (Mean, Sd) UCL
Hiker	EU4	Soil-Waste Rock	Iron	112627	95% Adjusted Gamma UCL
Hiker	EU4	Soil-Waste Rock	Manganese	55261	99% Chebyshev (Mean, Sd) UCL
Hiker	EU4	Soil-Waste Rock	Thallium	0.883	KM H-UCL
Hiker	EU4	Soil-Waste Rock	Zinc	51919	99% Chebyshev (Mean, Sd) UCL
Hunter	Deer	Game	Antimony	--	All non-detect
Hunter	Deer	Game	Arsenic	--	All non-detect
Hunter	Deer	Game	Cadmium	--	All non-detect
Hunter	Deer	Game	Chromium	0.776	95% Student's-t UCL
Hunter	Deer	Game	Chromium(III)	0.7	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hunter	Deer	Game	Chromium(VI)	0.08	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hunter	Deer	Game	Cobalt	--	All non-detect
Hunter	Deer	Game	Iron	29.46	95% Student's-t UCL
Hunter	Deer	Game	Manganese	0.345	Low detection frequency; value shown is the maximum detected concentration.
Hunter	Deer	Game	Mercury	--	All non-detect
Hunter	Deer	Game	Thallium	--	All non-detect
Hunter	Deer	Game	Zinc	40.84	95% Student's-t UCL
Hunter	EU1	Soil-Overbank	Antimony	3.983	95% KM (t) UCL
Hunter	EU1	Soil-Overbank	Arsenic	76.16	95% Adjusted Gamma UCL
Hunter	EU1	Soil-Overbank	Cadmium	25.94	KM H-UCL
Hunter	EU1	Soil-Overbank	Chromium	5.421	95% Student's-t UCL
Hunter	EU1	Soil-Overbank	Chromium(III)	4.9	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hunter	EU1	Soil-Overbank	Chromium(VI)	0.54	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hunter	EU1	Soil-Overbank	Cobalt	18.01	95% Adjusted Gamma UCL
Hunter	EU1	Soil-Overbank	Iron	37002	95% Modified-t UCL
Hunter	EU1	Soil-Overbank	Manganese	10872	95% Adjusted Gamma UCL
Hunter	EU1	Soil-Overbank	Thallium	0.654	95% KM (t) UCL
Hunter	EU1	Soil-Overbank	Zinc	1999	95% H-UCL

TABLE 4-10
EXPOSURE POINT CONCENTRATIONS
 Bonita Peak Mining District

Receptor	Exposure Unit	Media Type	Chemical Name	Exposure Point Concentration (EPC)	
				Value	Comments
Hunter	EU1	Soil-Waste Rock	Antimony	115.8	95% Adjusted Gamma UCL
Hunter	EU1	Soil-Waste Rock	Arsenic	271	95% H-UCL
Hunter	EU1	Soil-Waste Rock	Cadmium	25.06	95% Adjusted Gamma UCL
Hunter	EU1	Soil-Waste Rock	Chromium	2.98	95% Adjusted Gamma UCL
Hunter	EU1	Soil-Waste Rock	Chromium(III)	2.7	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hunter	EU1	Soil-Waste Rock	Chromium(VI)	0.30	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hunter	EU1	Soil-Waste Rock	Cobalt	10.8	95% H-UCL
Hunter	EU1	Soil-Waste Rock	Iron	41105	95% Student's-t UCL
Hunter	EU1	Soil-Waste Rock	Manganese	2480	95% Adjusted Gamma UCL
Hunter	EU1	Soil-Waste Rock	Thallium	2.518	95% KM Adjusted Gamma UCL
Hunter	EU1	Soil-Waste Rock	Zinc	7017	95% Adjusted Gamma UCL
Hunter	EU2	Soil-Overbank	Antimony	27.29	KM H-UCL
Hunter	EU2	Soil-Overbank	Arsenic	40.23	95% H-UCL
Hunter	EU2	Soil-Overbank	Cadmium	8.822	95% KM Adjusted Gamma UCL
Hunter	EU2	Soil-Overbank	Chromium	5.794	95% Student's-t UCL
Hunter	EU2	Soil-Overbank	Chromium(III)	5.2	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hunter	EU2	Soil-Overbank	Chromium(VI)	0.58	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hunter	EU2	Soil-Overbank	Cobalt	13.16	95% Student's-t UCL
Hunter	EU2	Soil-Overbank	Iron	40511	95% Student's-t UCL
Hunter	EU2	Soil-Overbank	Manganese	11796	95% Chebyshev (Mean, Sd) UCL
Hunter	EU2	Soil-Overbank	Thallium	0.428	95% KM (t) UCL
Hunter	EU2	Soil-Overbank	Zinc	2443	95% H-UCL
Hunter	EU2	Soil-Waste Rock	Antimony	19.4	95% KM Approximate Gamma UCL
Hunter	EU2	Soil-Waste Rock	Arsenic	48.35	95% Chebyshev (Mean, Sd) UCL
Hunter	EU2	Soil-Waste Rock	Cadmium	23.27	95% Chebyshev (Mean, Sd) UCL
Hunter	EU2	Soil-Waste Rock	Chromium	5.139	95% KM (t) UCL
Hunter	EU2	Soil-Waste Rock	Chromium(III)	4.6	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hunter	EU2	Soil-Waste Rock	Chromium(VI)	0.51	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hunter	EU2	Soil-Waste Rock	Cobalt	10.56	95% KM (t) UCL
Hunter	EU2	Soil-Waste Rock	Iron	30533	95% Student's-t UCL
Hunter	EU2	Soil-Waste Rock	Manganese	25324	95% Chebyshev (Mean, Sd) UCL
Hunter	EU2	Soil-Waste Rock	Thallium	0.308	95% KM Approximate Gamma UCL
Hunter	EU2	Soil-Waste Rock	Zinc	5180	95% Chebyshev (Mean, Sd) UCL
Hunter	EU3	Soil-Overbank	Antimony	2.757	95% Approximate Gamma UCL
Hunter	EU3	Soil-Overbank	Arsenic	41.45	95% Student's-t UCL
Hunter	EU3	Soil-Overbank	Cadmium	7.297	KM H-UCL
Hunter	EU3	Soil-Overbank	Chromium	5.572	95% Chebyshev (Mean, Sd) UCL
Hunter	EU3	Soil-Overbank	Chromium(III)	5.0	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hunter	EU3	Soil-Overbank	Chromium(VI)	0.56	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hunter	EU3	Soil-Overbank	Cobalt	9.078	95% KM Approximate Gamma UCL
Hunter	EU3	Soil-Overbank	Iron	55155	95% Modified-t UCL
Hunter	EU3	Soil-Overbank	Manganese	2836	95% H-UCL
Hunter	EU3	Soil-Overbank	Thallium	1	Low detection frequency; value shown is the maximum detected concentration.
Hunter	EU3	Soil-Overbank	Zinc	1133	95% Chebyshev (Mean, Sd) UCL
Hunter	EU3	Soil-Waste Rock	Antimony	45.02	95% Adjusted Gamma UCL
Hunter	EU3	Soil-Waste Rock	Arsenic	106.6	95% Student's-t UCL
Hunter	EU3	Soil-Waste Rock	Cadmium	13.78	95% Adjusted Gamma UCL
Hunter	EU3	Soil-Waste Rock	Chromium	4.279	95% Student's-t UCL
Hunter	EU3	Soil-Waste Rock	Chromium(III)	3.9	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hunter	EU3	Soil-Waste Rock	Chromium(VI)	0.43	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hunter	EU3	Soil-Waste Rock	Cobalt	9.959	95% Adjusted Gamma UCL
Hunter	EU3	Soil-Waste Rock	Iron	83648	95% H-UCL
Hunter	EU3	Soil-Waste Rock	Manganese	1287	95% H-UCL
Hunter	EU3	Soil-Waste Rock	Thallium	0.421	95% Student's-t UCL
Hunter	EU3	Soil-Waste Rock	Zinc	9608	95% Adjusted Gamma UCL
Hunter	EU4	Soil-Overbank	Antimony	2.53	KM H-UCL
Hunter	EU4	Soil-Overbank	Arsenic	56.24	KM H-UCL
Hunter	EU4	Soil-Overbank	Cadmium	2.925	KM H-UCL
Hunter	EU4	Soil-Overbank	Chromium	4.743	95% Approximate Gamma UCL
Hunter	EU4	Soil-Overbank	Chromium(III)	4.3	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hunter	EU4	Soil-Overbank	Chromium(VI)	0.47	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hunter	EU4	Soil-Overbank	Cobalt	15.65	95% H-UCL
Hunter	EU4	Soil-Overbank	Iron	61544	95% H-UCL
Hunter	EU4	Soil-Overbank	Manganese	1986	95% H-UCL
Hunter	EU4	Soil-Overbank	Thallium	0.125	95% KM (Chebyshev) UCL
Hunter	EU4	Soil-Overbank	Zinc	458.1	95% H-UCL

TABLE 4-10
EXPOSURE POINT CONCENTRATIONS
 Bonita Peak Mining District

Receptor	Exposure Unit	Media Type	Chemical Name	Exposure Point Concentration (EPC)	
				Value	Comments
Hunter	EU4	Soil-Waste Rock	Antimony	77.26	95% Adjusted Gamma UCL
Hunter	EU4	Soil-Waste Rock	Arsenic	10393	99% Chebyshev (Mean, Sd) UCL
Hunter	EU4	Soil-Waste Rock	Cadmium	170.7	UCL exceeded maximum conc; value shown is UCL. 99% KM (Chebyshev) UCL
Hunter	EU4	Soil-Waste Rock	Chromium	7.438	95% Adjusted Gamma UCL
Hunter	EU4	Soil-Waste Rock	Chromium(III)	6.7	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hunter	EU4	Soil-Waste Rock	Chromium(VI)	0.74	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hunter	EU4	Soil-Waste Rock	Cobalt	45.95	95% Chebyshev (Mean, Sd) UCL
Hunter	EU4	Soil-Waste Rock	Iron	112627	95% Adjusted Gamma UCL
Hunter	EU4	Soil-Waste Rock	Manganese	55261	99% Chebyshev (Mean, Sd) UCL
Hunter	EU4	Soil-Waste Rock	Thallium	0.883	KM H-UCL
Hunter	EU4	Soil-Waste Rock	Zinc	51919	99% Chebyshev (Mean, Sd) UCL
Hunter	Grouse	Game	Antimony	--	All non-detect
Hunter	Grouse	Game	Arsenic	--	All non-detect
Hunter	Grouse	Game	Cadmium	0.023	Low detection frequency; value shown is the maximum detected concentration.
Hunter	Grouse	Game	Chromium	0.89	95% Student's-t UCL
Hunter	Grouse	Game	Chromium(III)	0.8	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hunter	Grouse	Game	Chromium(VI)	0.09	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Hunter	Grouse	Game	Cobalt	--	All non-detect
Hunter	Grouse	Game	Iron	--	All non-detect
Hunter	Grouse	Game	Manganese	--	All non-detect
Hunter	Grouse	Game	Mercury	--	All non-detect
Hunter	Grouse	Game	Thallium	--	All non-detect
Hunter	Grouse	Game	Zinc	4.919	UCL exceeded maximum conc; value shown is UCL. 95% Student's-t UCL
Recreational Fisherman	EU8	Fish	Aluminum	--	All non-detect
Recreational Fisherman	EU8	Fish	Antimony	--	All non-detect
Recreational Fisherman	EU8	Fish	Arsenic	0.43	95% KM (t) UCL
Recreational Fisherman	EU8	Fish	Beryllium	--	All non-detect
Recreational Fisherman	EU8	Fish	Cadmium	0.0448	95% Student's-t UCL
Recreational Fisherman	EU8	Fish	Chromium	0.861	95% Student's-t UCL
Recreational Fisherman	EU8	Fish	Chromium(III)	0.8	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Recreational Fisherman	EU8	Fish	Chromium(VI)	0.09	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Recreational Fisherman	EU8	Fish	Copper	0.537	95% Student's-t UCL
Recreational Fisherman	EU8	Fish	Iron	--	All non-detect
Recreational Fisherman	EU8	Fish	Manganese	--	All non-detect
Recreational Fisherman	EU8	Fish	Mercury	0.0455	95% Student's-t UCL
Recreational Fisherman	EU8	Fish	Strontium	0.624	95% KM (t) UCL
Recreational Fisherman	EU8	Fish	Thallium	--	All non-detect
Recreational Fisherman	EU8	Fish	Zinc	10.08	95% Student's-t UCL
Recreational Fisherman	EU8	Sediment	Arsenic	154.4	95% Chebyshev (Mean, Sd) UCL
Recreational Fisherman	EU8	Sediment	Cadmium	3.722	95% Approximate Gamma UCL
Recreational Fisherman	EU8	Sediment	Chromium	3.284	95% KM (t) UCL
Recreational Fisherman	EU8	Sediment	Chromium(III)	3.0	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Recreational Fisherman	EU8	Sediment	Chromium(VI)	0.33	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Recreational Fisherman	EU8	Sediment	Cobalt	17.99	95% Adjusted Gamma UCL
Recreational Fisherman	EU8	Sediment	Copper	258.5	95% H-UCL
Recreational Fisherman	EU8	Sediment	Iron	61175	95% Modified-t UCL
Recreational Fisherman	EU8	Sediment	Manganese	1925	95% Approximate Gamma UCL
Recreational Fisherman	EU8	Sediment	Thallium	0.184	95% KM Approximate Gamma UCL
Recreational Fisherman	EU8	Sediment	Zinc	1349	95% H-UCL
Recreational Fisherman	EU8	Surface Water	Aluminum	3.351	KM H-UCL
Recreational Fisherman	EU8	Surface Water	Antimony	--	All non-detect
Recreational Fisherman	EU8	Surface Water	Arsenic	0.002388	95% KM Approximate Gamma UCL
Recreational Fisherman	EU8	Surface Water	Beryllium	0.000165	95% KM (t) UCL
Recreational Fisherman	EU8	Surface Water	Cadmium	0.002103	95% KM (Chebyshev) UCL
Recreational Fisherman	EU8	Surface Water	Chromium	0.0004	Low detection frequency; value shown is the maximum detected concentration.
Recreational Fisherman	EU8	Surface Water	Chromium(III)	0.00036	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Recreational Fisherman	EU8	Surface Water	Chromium(VI)	0.000040	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Recreational Fisherman	EU8	Surface Water	Cobalt	0.007073	95% KM Approximate Gamma UCL
Recreational Fisherman	EU8	Surface Water	Copper	0.04624	95% KM (Chebyshev) UCL
Recreational Fisherman	EU8	Surface Water	Iron	3.21	95% KM (Chebyshev) UCL
Recreational Fisherman	EU8	Surface Water	Manganese	0.62	95% KM (Chebyshev) UCL
Recreational Fisherman	EU8	Surface Water	Strontium	0.683	95% Chebyshev (Mean, Sd) UCL
Recreational Fisherman	EU8	Surface Water	Thallium	0.000911	95% KM (t) UCL
Recreational Fisherman	EU8	Surface Water	Zinc	0.8436	95% KM (Chebyshev) UCL

TABLE 4-10
EXPOSURE POINT CONCENTRATIONS
 Bonita Peak Mining District

Receptor	Exposure Unit	Media Type	Chemical Name	Exposure Point Concentration (EPC)	
				Value	Comments
Recreational Fisherman	EU9	Fish	Aluminum	--	All non-detect
Recreational Fisherman	EU9	Fish	Antimony	--	All non-detect
Recreational Fisherman	EU9	Fish	Arsenic	--	All non-detect
Recreational Fisherman	EU9	Fish	Beryllium	--	All non-detect
Recreational Fisherman	EU9	Fish	Cadmium	0.0814	UCL exceeded maximum conc; value shown is UCL. 95% Student's-t UCL
Recreational Fisherman	EU9	Fish	Chromium	1.267	95% Student's-t UCL
Recreational Fisherman	EU9	Fish	Chromium(III)	1.1	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Recreational Fisherman	EU9	Fish	Chromium(VI)	0.13	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Recreational Fisherman	EU9	Fish	Copper	0.583	95% Student's-t UCL
Recreational Fisherman	EU9	Fish	Iron	--	All non-detect
Recreational Fisherman	EU9	Fish	Manganese	0.362	95% KM (t) UCL
Recreational Fisherman	EU9	Fish	Mercury	0.0253	95% Student's-t UCL
Recreational Fisherman	EU9	Fish	Strontium	0.712	95% Student's-t UCL
Recreational Fisherman	EU9	Fish	Thallium	--	All non-detect
Recreational Fisherman	EU9	Fish	Zinc	18.06	95% Student's-t UCL
Recreational Fisherman	EU9	Sediment	Arsenic	37.57	95% Chebyshev (Mean, Sd) UCL
Recreational Fisherman	EU9	Sediment	Cadmium	12.4	95% Approximate Gamma UCL
Recreational Fisherman	EU9	Sediment	Chromium	5.569	95% Student's-t UCL
Recreational Fisherman	EU9	Sediment	Chromium(III)	5.0	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Recreational Fisherman	EU9	Sediment	Chromium(VI)	0.56	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Recreational Fisherman	EU9	Sediment	Cobalt	12.5	95% Student's-t UCL
Recreational Fisherman	EU9	Sediment	Copper	600.8	95% Chebyshev (Mean, Sd) UCL
Recreational Fisherman	EU9	Sediment	Iron	27782	95% Student's-t UCL
Recreational Fisherman	EU9	Sediment	Manganese	13530	95% Chebyshev (Mean, Sd) UCL
Recreational Fisherman	EU9	Sediment	Zinc	2938	95% KM (Chebyshev) UCL
Recreational Fisherman	EU9	Sediment	Thallium	18.31	95% Approximate Gamma UCL
Recreational Fisherman	EU9	Surface Water	Aluminum	0.3209	KM H-UCL
Recreational Fisherman	EU9	Surface Water	Antimony	0.00504	Low detection frequency; value shown is the maximum detected concentration.
Recreational Fisherman	EU9	Surface Water	Arsenic	0.000206	95% KM Approximate Gamma UCL
Recreational Fisherman	EU9	Surface Water	Beryllium	0.00032	95% KM (t) UCL
Recreational Fisherman	EU9	Surface Water	Cadmium	0.002184	95% KM (Chebyshev) UCL
Recreational Fisherman	EU9	Surface Water	Chromium	0.0018	Low detection frequency; value shown is the maximum detected concentration.
Recreational Fisherman	EU9	Surface Water	Chromium(III)	0.0016	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Recreational Fisherman	EU9	Surface Water	Chromium(VI)	0.00018	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Recreational Fisherman	EU9	Surface Water	Cobalt	0.00047	95% KM (t) UCL
Recreational Fisherman	EU9	Surface Water	Copper	0.015	KM H-UCL
Recreational Fisherman	EU9	Surface Water	Iron	0.62	95% KM (Chebyshev) UCL
Recreational Fisherman	EU9	Surface Water	Manganese	2.2	95% Chebyshev (Mean, Sd) UCL
Recreational Fisherman	EU9	Surface Water	Strontium	0.42	95% Chebyshev (Mean, Sd) UCL
Recreational Fisherman	EU9	Surface Water	Thallium	0.0017	KM H-UCL
Recreational Fisherman	EU9	Surface Water	Zinc	1.0	95% KM (Chebyshev) UCL
Road Worker	EU1	Air	Antimony	--	Samples were not analyzed for this chemical.
Road Worker	EU1	Air	Arsenic	--	All non-detect
Road Worker	EU1	Air	Cadmium	--	Samples were not analyzed for this chemical.
Road Worker	EU1	Air	Chromium	0.00023	UCL exceeded maximum conc; value shown is UCL. 95% Student's-t UCL
Road Worker	EU1	Air	Chromium(III)	0.000206	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Road Worker	EU1	Air	Chromium(VI)	0.00	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Road Worker	EU1	Air	Cobalt	--	Samples were not analyzed for this chemical.
Road Worker	EU1	Air	Iron	--	Samples were not analyzed for this chemical.
Road Worker	EU1	Air	Manganese	0.00019	UCL exceeded maximum conc; value shown is UCL. 95% Student's-t UCL
Road Worker	EU1	Air	Thallium	--	Samples were not analyzed for this chemical.
Road Worker	EU1	Air	Zinc	--	Samples were not analyzed for this chemical.
Road Worker	EU1	Soil-Roadway	Antimony	14.36	95% H-UCL
Road Worker	EU1	Soil-Roadway	Arsenic	79.51	95% Adjusted Gamma UCL
Road Worker	EU1	Soil-Roadway	Cadmium	4.23	95% Adjusted Gamma UCL
Road Worker	EU1	Soil-Roadway	Chromium	5.739	95% Adjusted Gamma UCL
Road Worker	EU1	Soil-Roadway	Chromium(III)	5.2	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Road Worker	EU1	Soil-Roadway	Chromium(VI)	0.57	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Road Worker	EU1	Soil-Roadway	Cobalt	11.92	95% H-UCL
Road Worker	EU1	Soil-Roadway	Iron	31137	95% Student's-t UCL
Road Worker	EU1	Soil-Roadway	Manganese	7799	95% Chebyshev (Mean, Sd) UCL
Road Worker	EU1	Soil-Roadway	Thallium	0.948	95% H-UCL
Road Worker	EU1	Soil-Roadway	Zinc	1075	95% Adjusted Gamma UCL
Road Worker	EU2	Air	Antimony	--	Samples were not analyzed for this chemical.
Road Worker	EU2	Air	Arsenic	--	All non-detect
Road Worker	EU2	Air	Cadmium	--	Samples were not analyzed for this chemical.
Road Worker	EU2	Air	Chromium	0.00023	UCL exceeded maximum conc; value shown is UCL. 95% Student's-t UCL
Road Worker	EU2	Air	Chromium(III)	0.000206	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Road Worker	EU2	Air	Chromium(VI)	0.00	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Road Worker	EU2	Air	Cobalt	--	Samples were not analyzed for this chemical.
Road Worker	EU2	Air	Iron	--	Samples were not analyzed for this chemical.
Road Worker	EU2	Air	Manganese	0.00019	UCL exceeded maximum conc; value shown is UCL. 95% Student's-t UCL
Road Worker	EU2	Air	Thallium	--	Samples were not analyzed for this chemical.
Road Worker	EU2	Air	Zinc	--	Samples were not analyzed for this chemical.

TABLE 4-10
EXPOSURE POINT CONCENTRATIONS
 Bonita Peak Mining District

Receptor	Exposure Unit	Media Type	Chemical Name	Exposure Point Concentration (EPC)	
				Value	Comments
Road Worker	EU2	Soil-Roadway	Antimony	3.78	95% Chebyshev (Mean, Sd) UCL
Road Worker	EU2	Soil-Roadway	Arsenic	34.28	95% Adjusted Gamma UCL
Road Worker	EU2	Soil-Roadway	Cadmium	7.882	95% Chebyshev (Mean, Sd) UCL
Road Worker	EU2	Soil-Roadway	Chromium	4.65	95% Student's-t UCL
Road Worker	EU2	Soil-Roadway	Chromium(III)	4.2	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Road Worker	EU2	Soil-Roadway	Chromium(VI)	0.47	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Road Worker	EU2	Soil-Roadway	Cobalt	6.801	95% Student's-t UCL
Road Worker	EU2	Soil-Roadway	Iron	25070	95% Student's-t UCL
Road Worker	EU2	Soil-Roadway	Manganese	2439	95% Adjusted Gamma UCL
Road Worker	EU2	Soil-Roadway	Thallium	0.206	KM H-UCL
Road Worker	EU2	Soil-Roadway	Zinc	1983	95% Chebyshev (Mean, Sd) UCL
Road Worker	EU3	Air	Antimony	--	Samples were not analyzed for this chemical.
Road Worker	EU3	Air	Arsenic	--	All non-detect
Road Worker	EU3	Air	Cadmium	--	Samples were not analyzed for this chemical.
Road Worker	EU3	Air	Chromium	0.00024	UCL exceeded maximum conc; value shown is UCL. 95% Student's-t UCL
Road Worker	EU3	Air	Chromium(III)	0.000212	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Road Worker	EU3	Air	Chromium(VI)	0.00	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Road Worker	EU3	Air	Cobalt	--	Samples were not analyzed for this chemical.
Road Worker	EU3	Air	Iron	--	Samples were not analyzed for this chemical.
Road Worker	EU3	Air	Manganese	0.00047	UCL exceeded maximum conc; value shown is UCL. 95% Student's-t UCL
Road Worker	EU3	Air	Thallium	--	Samples were not analyzed for this chemical.
Road Worker	EU3	Air	Zinc	--	Samples were not analyzed for this chemical.
Road Worker	EU3	Soil-Roadway	Antimony	1.733	95% Student's-t UCL
Road Worker	EU3	Soil-Roadway	Arsenic	19.2	95% Student's-t UCL
Road Worker	EU3	Soil-Roadway	Cadmium	1.583	95% Student's-t UCL
Road Worker	EU3	Soil-Roadway	Chromium	6.907	95% Student's-t UCL
Road Worker	EU3	Soil-Roadway	Chromium(III)	6.2	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Road Worker	EU3	Soil-Roadway	Chromium(VI)	0.69	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Road Worker	EU3	Soil-Roadway	Cobalt	8.091	95% Student's-t UCL
Road Worker	EU3	Soil-Roadway	Iron	121632	95% Chebyshev (Mean, Sd) UCL
Road Worker	EU3	Soil-Roadway	Manganese	936	95% Student's-t UCL
Road Worker	EU3	Soil-Roadway	Thallium	0.205	95% H-UCL
Road Worker	EU3	Soil-Roadway	Zinc	658.7	95% Student's-t UCL
Road Worker	EU4	Air	Antimony	--	Samples were not analyzed for this chemical.
Road Worker	EU4	Air	Arsenic	--	All non-detect
Road Worker	EU4	Air	Cadmium	--	Samples were not analyzed for this chemical.
Road Worker	EU4	Air	Chromium	0.00024	UCL exceeded maximum conc; value shown is UCL. 95% Student's-t UCL
Road Worker	EU4	Air	Chromium(III)	0.000218	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Road Worker	EU4	Air	Chromium(VI)	0.00	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Road Worker	EU4	Air	Cobalt	--	Samples were not analyzed for this chemical.
Road Worker	EU4	Air	Iron	--	Samples were not analyzed for this chemical.
Road Worker	EU4	Air	Manganese	0.000056	UCL exceeded maximum conc; value shown is UCL. 95% Student's-t UCL
Road Worker	EU4	Air	Thallium	--	Samples were not analyzed for this chemical.
Road Worker	EU4	Air	Zinc	--	Samples were not analyzed for this chemical.
Road Worker	EU4	Soil-Roadway	Antimony	0.662	95% KM (t) UCL
Road Worker	EU4	Soil-Roadway	Arsenic	15.39	95% Student's-t UCL
Road Worker	EU4	Soil-Roadway	Cadmium	64.84	UCL exceeded maximum conc; value shown is UCL. 99% Chebyshev(Mean, Sd) UCL
Road Worker	EU4	Soil-Roadway	Chromium	7.4	95% H-UCL
Road Worker	EU4	Soil-Roadway	Chromium(III)	6.7	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Road Worker	EU4	Soil-Roadway	Chromium(VI)	0.74	calculated using assumed 90:10 ratio (chromium III: chromium VI)
Road Worker	EU4	Soil-Roadway	Cobalt	20.25	95% Adjusted Gamma UCL
Road Worker	EU4	Soil-Roadway	Iron	31333	95% Student's-t UCL
Road Worker	EU4	Soil-Roadway	Manganese	19809	UCL exceeded maximum conc; value shown is UCL. 99% Chebyshev(Mean, Sd) UCL
Road Worker	EU4	Soil-Roadway	Thallium	0.11	95% KM (t) UCL
Road Worker	EU4	Soil-Roadway	Zinc	5972	UCL exceeded maximum conc; value shown is UCL. 99% Chebyshev(Mean, Sd) UCL
ATV Guide	EU5a	Air	Aluminum	0.0141	Average concentration for following rider air.
ATV Guide	EU5a	Air	Antimony	--	Samples were not analyzed for this chemical.
ATV Guide	EU5a	Air	Arsenic	--	All non-detect
ATV Guide	EU5a	Air	Beryllium	--	All non-detect
ATV Guide	EU5a	Air	Cadmium	--	All non-detect
ATV Guide	EU5a	Air	Calcium	0.0086	Average concentration for following rider air.
ATV Guide	EU5a	Air	Chromium	--	All non-detect
ATV Guide	EU5a	Air	Chromium(III)	--	All non-detect
ATV Guide	EU5a	Air	Chromium(VI)	--	All non-detect
ATV Guide	EU5a	Air	Cobalt	--	Samples were not analyzed for this chemical.
ATV Guide	EU5a	Air	Copper	--	All non-detect
ATV Guide	EU5a	Air	Iron	0.0146	Average concentration for following rider air.
ATV Guide	EU5a	Air	Lead	--	All non-detect
ATV Guide	EU5a	Air	Manganese	0.00076	Average concentration for following rider air.
ATV Guide	EU5a	Air	Nickel	0.000080	Average concentration for following rider air.
ATV Guide	EU5a	Air	Selenium	--	All non-detect
ATV Guide	EU5a	Air	Silver	--	All non-detect
ATV Guide	EU5a	Air	Sodium	0.014	Average concentration for following rider air.
ATV Guide	EU5a	Air	Strontium	--	Samples were not analyzed for this chemical.
ATV Guide	EU5a	Air	Thallium	--	Samples were not analyzed for this chemical.
ATV Guide	EU5a	Air	Zinc	0.00021	Average concentration for following rider air.

Units:
 Surface Water = mg/L
 Soil = mg/kg
 Sediment = mg/kg
 Fish = mg/kg
 Air = µg/m³
 mg = milligram
 µg = microgram
 kg = kilogram
 L = liter
 m = meter

TABLE 4-11
IN VITRO BIOACCESSIBILITY OF ARSENIC IN SITE SOIL SAMPLES
Bonita Peak Mining District

Sample Type	Sample Number	Soil Arsenic Concentration (mg/kg)	IVBA (as fraction)	RBA* (as fraction)
Campgrounds	A8M5-5872	17	0	0.03
	A8M5-5873	114	0	0.03
	A8M5-5874	81	0.04	0.06
	A8M5-5875	60	0.13	0.14
	Average			0.07
Roadway	MH1F62	22	0.11	0.11
	MH1F63	36	0.07	0.08
	MH1F64	74	0.09	0.10
	MH1F65	285	0.08	0.09
	MH1F66	66	0	0.03
	MH1F67	168	0.02	0.04
	Average			0.08
Waste Rock	MH1F68	151	0	0.04
	MH1F69	10	0	0.03
	MH1F70	10	0	0.03
	MH1F71	137	0.06	0.07
	MH1F72	31	0	0.03
	MH1F73	235	0.03	0.05
	MH1F74	77	0.01	0.04
	MH1F75	80	0.01	0.04
	MH1F76	102	0.05	0.07
	MH1F77	139	0.01	0.04
	MH1F78	171	0	0.03
	MH1F79	184	0.02	0.05
	MH1F80	3,338	0.05	0.07
	MH1F81	18,320	0.05	0.07
	MH1F82	1,647	0.07	0.08
	MH1F83	107	0.03	0.06
	MH1F84	111	0.03	0.06
	MH1F85	326	0.06	0.08
Average RBA (%)			0.05	

* RBA(%) = 0.79 x IVBA(%) + 3.0

Average across all media **0.06**

Notes:

IVBA = *in vitro* bioaccessibility

mg/kg = milligrams per kilogram

RBA = relative bioavailability (*in vivo*)

TABLE 4-12
TOXICITY VALUES
 Bonita Peak Mining District

Analyte ^[1]	Oral Exposure						Inhalation Exposure						GI _{ABS}
	Non Cancer			Cancer			Non Cancer			Cancer			
	RfD (mg/kg day)	Key	Target Organ	SF (mg/kg day) ¹	Key	Cancer WOE	RfC (mg/m ³)	Key	Target Organ	IUR (μg/m ³) ¹	Key	Cancer WOE	
Aluminum	1	P	Neurological				0.005	P	Neurological				1
Antimony	0.0004	I	Longevity/Blood										0.15
Arsenic	0.0003	I	Skin	1.5	I	A	0.000015	C	Developmental/ Cardiovascular System/CNS/Lung/Skin	0.0043	I	A	1
Barium	0.2	I	Kidney				0.0005	H	Fetus				0.07
Beryllium	0.002	I	Intestine				0.00002	I	Lung	0.0024	I	A	0.007
Cadmium (Diet)	0.001	I	Kidney				0.00001	A	Kidney	0.0018	I	A	0.025
Cadmium (Water)	0.0005	I	Kidney				0.00001	A	Kidney	0.0018	I	A	0.05
Chromium (III)	1.5	I	GI Tract										0.013
Chromium (VI) ^[4]	0.003	I	GI Tract	0.5	C	NA	0.0001	I	Lung	0.084	S	A ^[5]	0.025
Cobalt	0.0003	P	Thyroid				0.000006	P	Respiratory System/ Lung	0.009	P	NA	1
Copper	0.04	H	GI Tract										1
Iron	0.7	P	GI Tract										1
Manganese (Non-Diet)	0.047	I ^[3]	CNS				0.00005	I	CNS				0.04
Manganese (Diet)	0.14	I	CNS				0.00005	I	CNS				1
Mercury	0.0003	I	Immune System				0.0003	I, S	Nervous System				0.07
Molybdenum	0.005	I	Urinary System										1
Nickel	0.02	I	Body and Organ Weight				0.00009	A	Respiratory System	0.00026	C	NA	0.04
Selenium	0.005	I	Nervous System/ Blood/Skin				0.02	C	Liver/Cardiovascular System/Nervous System				1
Silver	0.005	I	Skin										0.04
Strontium	0.6	I	Musculoskeletal										1
Thallium	0.00001	X	Skin/Hair										1
Vanadium	0.005	A, S	Kidney				0.0001	A	Respiratory System				0.026
Zinc	0.3	I	Blood/Immune										1

Source: EPA RSL table, November 2018 (EPA 2018b)

Notes:

- [1] Lead is not included in this summary because it is evaluated in a different manner (see Section 5).
- [2] RfD/RfC values and target organs for hydrogen cyanide and cyanide salts have been used as surrogate values for cyanide.
- [3] The RfD for manganese in soil and water (4.7E-02 mg/kg-day) is based on the oral RfD of 1.4E-01 mg/kg-day in the diet. In accordance with recommendations in IRIS, for application to exposures from soil or water, the RfD was adjusted by dividing by a modifying factor of 3.
- [4] Chromium has a mutagenic mode of action (see Section 4.2.1.2).
- [5] IRIS IUR adjusted based on an assumed Cr(VI) to Cr(III) ratio of 1:6 (i.e., multiplied by 7).

Key Sources:

- A = ATSDR
- C = California EPA
- H = HEAST
- I = IRIS
- P = PPRTV
- S = see RSL User Guide, Section 5
- X = PPRTV Appendix

Links to toxicity value databases:

- IRIS <http://cfpub.epa.gov/ncea/iris/index.cfm?fuseaction=iris.showSubstanceList>
- EPA RSLs <https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>
- PPRTV <https://hhpprtv.ornl.gov/>
- HEAST nepis.epa.gov/Exe/ZyPURL.cgi?Dockkey=200172JM.TXT
- ATSDR <https://www.atsdr.cdc.gov/toxprofiles/index.asp>
- CalEPA <https://oehha.ca.gov/chemicals>

(μg/m³)⁻¹ = (risk) per micrograms per cubic meter of air
 (mg/kg-day)⁻¹ = (risk) per milligrams per kilograms of body weight per day
 CNS = central nervous system
 EPA = U.S. Environmental Protection Agency
 GI = gastrointestinal
 GI_{ABS} = fraction of contaminant absorbed in gastrointestinal tract
 IUR = inhalation unit risk
 mg/kg-day = milligrams per kilograms of body weight per day

mg/m³ = milligrams per cubic meter of air
 NA = not available
 RfC = reference concentration
 RfD = reference dose
 RSL = Regional Screening Level
 SF = oral slope factor
 WOE = weight of evidence

TABLE 4-13

SUMMARY OF ESTIMATED REASONABLE MAXIMUM EXPOSURE RISKS FOR NON-LEAD COPCS

Bonita Peak Mining District

Exposed Population	Exposed Location	Exposure Medium	Exposure Route and Pathway	Non Cancer HI	Excess Cancer Risk
ATV Guide	EU5a	Roadway Soil	Soil Inhalation	3E-01	0E+00
		Roadway Soil	Incidental Soil Ingestion	3E-02	2E-07
		Total		3E-01	2E-07
ATV Rider	EU5b	Roadway Soil	Soil Inhalation	9E-01	1E-06
		Roadway Soil	Incidental Soil Ingestion	1E-01	5E-07
		Total		1E+00	2E-06
Hiker	EU1	Overbank/WR	Incidental Soil Ingestion	2E-01	6E-06
	EU2	Overbank/WR	Incidental Soil Ingestion	1E-01	3E-06
	EU3	Overbank/WR	Incidental Soil Ingestion	8E-02	3E-06
	EU4	Overbank/WR	Incidental Soil Ingestion	1E-01	1E-05
Camper - USFS Campground	EU6	SW	Incidental SW Ingestion	9E-03	NC
		GW	Ingestion of GW (as drinking water)	2E-04	1E-07
		Sediment	Incidental Sed Ingestion	4E-02	6E-08
		Campground Soil	Incidental Soil Ingestion	5E-02	1E-07
		Total		1E-01	3E-07
Camper - Dispersed	EU7	SW	Incidental SW Ingestion	4E-03	9E-09
		SW	Ingestion of SW (as drinking water)	9E-01	2E-06
		Sediment	Incidental Sed Ingestion	1E-01	1E-07
		Campground Soil	Incidental Soil Ingestion	2E-01	5E-07
		Total		1E+00	3E-06
Fisherman	EU8	SW	Incidental SW Ingestion	3E-03	2E-08
		Sediment	Incidental Sed Ingestion	8E-02	1E-06
		Fish Tissue	Fish Ingestion	3E-01	3E-05
		Total		4E-01	3E-05
	EU9	SW	Incidental SW Ingestion	6E-03	3E-09
		Sediment	Incidental Sed Ingestion	7E-01	3E-07
		Fish Tissue	Fish Ingestion	5E-02	5E-06
		Total		8E-01	6E-06
Hunter	EU1	Grouse Tissue	Ingestion of Grouse	1E-02	3E-06
		Deer Tissue	Ingestion of Deer	2E-01	2E-05
		Overbank/WR	Incidental Soil Ingestion	5E-02	2E-06
		Total		3E-01	3E-05
	EU2	Grouse Tissue	Ingestion of Grouse	1E-02	3E-06
		Deer Tissue	Ingestion of Deer	2E-01	2E-05
		Overbank/WR	Incidental Soil Ingestion	5E-02	9E-07
		Total		3E-01	3E-05
	EU3	Grouse Tissue	Ingestion of Grouse	1E-02	3E-06
		Deer Tissue	Ingestion of Deer	2E-01	2E-05
		Overbank/WR	Incidental Soil Ingestion	3E-02	1E-06
		Total		3E-01	3E-05
	EU4	Grouse Tissue	Ingestion of Grouse	1E-02	3E-06
		Deer Tissue	Ingestion of Deer	2E-01	2E-05
		Overbank/WR	Incidental Soil Ingestion	4E-02	4E-06
		Total		3E-01	3E-05

TABLE 4-13

SUMMARY OF ESTIMATED REASONABLE MAXIMUM EXPOSURE RISKS FOR NON-LEAD COPCs

Bonita Peak Mining District

Exposed Population	Exposed Location	Exposure Medium	Exposure Route and Pathway	Non Cancer HI	Excess Cancer Risk
Road Worker	EU1	Roadway Air	Soil Inhalation	4E-01	3E-05
		Roadway Soil	Incidental Soil Ingestion	6E-01	2E-06
		Total		1E+00	3E-05
	EU2	Roadway Air	Soil Inhalation	4E-01	3E-05
		Roadway Soil	Incidental Soil Ingestion	2E-01	7E-07
		Total		6E-01	3E-05
	EU3	Roadway Air	Soil Inhalation	9E-01	3E-05
		Roadway Soil	Incidental Soil Ingestion	3E-01	4E-07
		Total		1E+00	3E-05
	EU4	Roadway Air	Soil Inhalation	1E-01	3E-05
		Roadway Soil	Incidental Soil Ingestion	1E+00	4E-07
		Total		1E+00	3E-05

Notes:

NC = all carcinogenic COPCs in surface water were non-detect

COPC = chemical of potential concern

EU = exposure unit

GW = groundwater

Mn = manganese

NC = non calculated

RME = reasonable maximum exposure

Sed = sediment

SW = surface water

TI = thallium

WR = waste rock

TABLE 4-15

DETECTION LIMIT ADEQUACY EVALUATION FOR NON-DETECT CHEMICALS - EVALUATION OF RISK

Bonita Peak Mining District

Ingestion of Groundwater as Drinking Water (Camper USFS EU6)

Chemical of Potential Concern	Cwater (mg/L)	RBA (unitless)	Non Cancer Hazard							Cancer Risk						
			HIFNC (L/kg d)		DI (L/kg d)			Oral RfD (mg/kg d)	HQ	HIFCancer (L/kg d)		DI (L/kg d)			Oral SF (mg/kg d) ¹	Risk
			Adult	Child	Adult	Child	Total			Adult	Child	Adult	Child	Total		
Arsenic	3.75E-02	1.0	1.69E-03	6.39E-04	6.3E-05	2.4E-05	8.7E-05	3.00E-04	2E-01	4.83E-04	1.83E-05	1.8E-05	6.8E-07	1.9E-05	1.50E+00	3E-05

Notes:

All concentration inputs are based on one-half the average method detection limit.

- = not calculated
- Cwater = water concentration
- d = day
- DI = dietary intake
- HIF = human intake factor
- HQ = hazard quotient
- kg = kilogram
- L = liter
- m = meter
- mg = milligram
- NA = not available
- NC = non-cancer
- RBA = relative bioavailabilty
- RfD = reference dose
- RME = reasonable maximum exposure
- SF = slope factor

TABLE 4-16
DETECTION LIMIT ADEQUACY EVALUATION FOR NON-DETECT COPCS - EVALUATION OF RISK
Bonita Peak Mining District

Panel A. Inhalation Caused by Human Disturbance (ATV Guide EU5a)

Chemical of Potential Concern	Cair (mg/m ³)	RBA (unitless)	Non Cancer Hazard				Cancer Risk			
			TWF (unitless)	EC (mg/m ³)	iRfC (mg/kg)	HQ	TWF (unitless)	EC (µg/m ³)	iUR (µg/m ³) ⁻¹	Risk
Arsenic	9.50E-04	1.0	1.97E-02	1.87E-05	1.50E-05	1E+00	5.64E-03	5.4E-03	4.30E-03	2E-05
Cadmium	2.88E-05	1.0	1.97E-02	5.68E-07	1.00E-05	6E-02	5.64E-03	1.6E-04	1.80E-03	3E-07
Chromium(III)	4.30E-04	1.0	1.97E-02	8.49E-06	NA	--	5.64E-03	2.4E-03	NA	--
Chromium(VI)	4.78E-05	1.0	1.97E-02	9.43E-07	1.00E-04	9E-03	5.64E-03	2.7E-04	8.40E-02	2E-05

Panel B. Incidental Ingestion of Surface Water (Camper USFS EU6)

Chemical of Potential Concern	Cwater (mg/L)	RBA (unitless)	Non Cancer Hazard						Cancer Risk								
			HIFNC (L/kg d)		DI (L/kg d)			Oral RfD (mg/kg d)	HQ	HIFCancer (L/kg d)			DI (L/kg d)			Oral SF (mg/kg d) ¹	Risk
			Adult	Child	Adult	Child	Total			Adult	Child	Adult	Child	Total			
Antimony	1.07E+00	1.0	7.20E-06	3.13E-06	7.7E-06	3.4E-06	1.1E-05	4.00E-04	2E-02	2.06E-06	8.95E-08	2.2E-06	9.6E-08	2.3E-06	NA	--	
Beryllium	8.60E-01	1.0	7.20E-06	3.13E-06	6.2E-06	2.7E-06	8.9E-06	2.00E-03	3E-03	2.06E-06	8.95E-08	1.8E-06	7.7E-08	1.8E-06	NA	--	
Chromium(III)	1.93E+00	1.0	7.20E-06	3.13E-06	1.4E-05	6.0E-06	2.0E-05	1.50E+00	9E-06	2.06E-06	8.95E-08	4.0E-06	1.7E-07	4.1E-06	NA	--	
Chromium(VI)	2.15E-01	1.0	7.20E-06	3.13E-06	1.5E-06	6.7E-07	2.2E-06	3.00E-03	5E-04	2.06E-06	8.95E-08	4.4E-07	1.9E-08	4.6E-07	5.00E-01	#REF!	
Copper	1.08E+00	1.0	7.20E-06	3.13E-06	7.7E-06	3.4E-06	1.1E-05	4.00E-02	2E-04	2.06E-06	8.95E-08	2.2E-06	9.6E-08	2.3E-06	NA	--	

Panel C. Incidental Ingestion of Sediment (Camper USFS EU6)

Chemical of Potential Concern	Csediment (mg/kg)	RBA (unitless)	Non Cancer Hazard						Cancer Risk								
			HIFNC (L/kg d)		DI (L/kg d)			Oral RfD (mg/kg d)	HQ	HIFCancer (L/kg d)			DI (L/kg d)			Oral SF (mg/kg d) ¹	Risk
			Adult	Child	Adult	Child	Total			Adult	Child	Adult	Child	Total			
Thallium	6.88E-02	1.0	6.76E-08	6.39E-08	4.6E-09	4.4E-09	9.0E-09	1.00E-05	5E-04	1.93E-08	1.83E-09	1.3E-09	1.3E-10	1.5E-09	NA	--	

Panel D. Incidental Ingestion of Surface Water (Fisherman EU8)

Chemical of Potential Concern	Cwater (mg/L)	RBA (unitless)	RME Non Cancer Risk				RME Cancer Risk			
			HIFNC (L/kg d)	DI (L/kg d)	Oral RfD (mg/kg d)	HQ	HIFCancer (L/kg d)	DI (L/kg d)	Oral SF (mg/kg d) ¹	Risk
Antimony	1.04E+00	1.0	2.06E-05	2.1E-05	4.00E-04	5E-02	5.87E-06	6.1E-06	NA	--

Panel E. Fish Ingestion (Fisherman EU8)

Chemical of Potential Concern	Cfish (mg/kg)	RBA (unitless)	RME Non Cancer Risk				RME Cancer Risk			
			HIFNC (kg/kg d)	DI (mg/kg d)	Oral RfD (mg/kg d)	HQ	HIFCancer (kg/kg d)	DI (mg/kg d)	Oral SF (mg/kg d) ¹	Risk
Aluminum	1.11E+00	1.0	1.45E-04	1.6E-04	1.00E+00	2E-04	4.15E-05	4.6E-05	NA	--
Antimony	2.78E-02	1.0	1.45E-04	4.0E-06	4.00E-04	1E-02	4.15E-05	1.2E-06	NA	--
Beryllium	5.56E-02	1.0	1.45E-04	8.1E-06	2.00E-03	4E-03	4.15E-05	2.3E-06	NA	--
Iron	5.57E+00	1.0	1.45E-04	8.1E-04	7.00E-01	1E-03	4.15E-05	2.3E-04	NA	--
Manganese	1.11E-01	1.0	1.45E-04	1.6E-05	1.40E-01	1E-04	4.15E-05	4.6E-06	NA	--
Thallium	5.57E-02	1.0	1.45E-04	8.1E-06	1.00E-05	8E-01	4.15E-05	2.3E-06	NA	--

Panel F. Fish Ingestion (Fisherman EU9)

Chemical of Potential Concern	Cfish (mg/kg)	RBA (unitless)	RME Non Cancer Risk				RME Cancer Risk			
			HIFNC (kg/kg d)	DI (mg/kg d)	Oral RfD (mg/kg d)	HQ	HIFCancer (kg/kg d)	DI (mg/kg d)	Oral SF (mg/kg d) ¹	Risk
Aluminum	9.92E-01	1.0	1.45E-04	1.4E-04	1.00E+00	1E-04	4.15E-05	4.1E-05	NA	--
Antimony	2.48E-02	1.0	1.45E-04	3.6E-06	4.00E-04	9E-03	4.15E-05	1.0E-06	NA	--
Arsenic	2.48E-02	1.0	1.45E-04	3.6E-06	3.00E-04	1E-02	4.15E-05	1.0E-06	1.50E+00	2E-06
Beryllium	4.94E-02	1.0	1.45E-04	7.2E-06	2.00E-03	4E-03	4.15E-05	2.1E-06	NA	--
Iron	4.96E+00	1.0	1.45E-04	7.2E-04	7.00E-01	1E-03	4.15E-05	2.1E-04	NA	--
Thallium	4.96E-02	1.0	1.45E-04	7.2E-06	1.00E-05	7E-01	4.15E-05	2.1E-06	NA	--

Panel G. Game Ingestion (Hunter) - Grouse

Chemical of Potential Concern	Ctissue (mg/kg)	RBA (unitless)	RME Non Cancer Risk				RME Cancer Risk			
			HIFNC (kg/kg d)	DI (mg/kg d)	Oral RfD (mg/kg d)	HQ	HIFCancer (kg/kg d)	DI (mg/kg d)	Oral SF (mg/kg d) ¹	Risk
Antimony	3.46E-02	1.0	1.37E-04	4.7E-06	4.00E-04	1E-02	3.91E-05	1.4E-06	NA	--
Arsenic	3.46E-02	1.0	1.37E-04	4.7E-06	3.00E-04	2E-02	3.91E-05	1.4E-06	1.50E+00	2E-06
Cobalt	6.91E-03	1.0	1.37E-04	9.5E-07	3.00E-04	3E-03	3.91E-05	2.7E-07	NA	--
Iron	6.91E+00	1.0	1.37E-04	9.5E-04	7.00E-01	1E-03	3.91E-05	2.7E-04	NA	--
Manganese	1.39E-01	1.0	1.37E-04	1.9E-05	2.40E-02	8E-04	3.91E-05	5.4E-06	NA	--
Mercury	6.30E-03	1.0	1.37E-04	8.6E-07	3.00E-04	3E-03	3.91E-05	2.5E-07	NA	--
Thallium	6.91E-02	1.0	1.37E-04	9.5E-06	1.00E-05	9E-01	3.91E-05	2.7E-06	NA	--

TABLE 4-16
DETECTION LIMIT ADEQUACY EVALUATION FOR NON-DETECT COPCS - EVALUATION OF RISK
Bonita Peak Mining District

Panel H. Game Ingestion (Hunter) - Deer

Chemical of Potential Concern	Ctissue (mg/kg)	RBA (unitless)	RME Non Cancer Risk				RME Cancer Risk			
			HIFNC (kg/kg d)	DI (mg/kg d)	Oral RfD (mg/kg d)	HQ	HIFCancer (kg/kg d)	DI (mg/kg d)	Oral SF (mg/kg d) ⁻¹	Risk
Antimony	3.24E-02	1.0	1.10E-03	3.5E-05	4.00E-04	9E-02	3.13E-04	1.0E-05	NA	--
Arsenic	3.24E-02	1.0	1.10E-03	3.5E-05	3.00E-04	1E-01	3.13E-04	1.0E-05	1.50E+00	2E-05
Cadmium	6.48E-03	1.0	1.10E-03	7.1E-06	1.00E-03	7E-03	3.13E-04	2.0E-06	NA	--
Cobalt	6.48E-03	1.0	1.10E-03	7.1E-06	3.00E-04	2E-02	3.13E-04	2.0E-06	NA	--
Mercury	8.08E-03	1.0	1.10E-03	8.8E-06	3.00E-04	3E-02	3.13E-04	2.5E-06	NA	--
Thallium	6.48E-02	1.0	1.10E-03	7.1E-05	1.00E-05	7E+00	3.13E-04	2.0E-05	NA	--

Panel I. Inhalation Caused by Human Disturbance (Road Worker)

Chemical of Potential Concern	Cair (mg/m ³)	RBA (unitless)	Non Cancer Hazard				Cancer Risk			
			TWF (unitless)	EC (mg/m ³)	iRfC (mg/kg)	HQ	TWF (unitless)	EC (μg/m ³)	iUR (μg/m ³) ⁻¹	Risk
Arsenic	4.71E-03	1.0	9.13E-02	4.30E-04	1.50E-05	3E+01	1.30E-02	6.1E-02	4.30E-03	3E-04

Notes:

All concentration inputs are based on one-half the average method detection limit.

Shaded values indicate risks are above EPA guidelines.

The toxicity values for chromium were assumed to be a 6:1 ratio of trivalent and hexavalent chromium.

- = not calculated
- Csed = sediment concentration
- Cwater = water concentration
- d = day
- DI = dietary intake
- EU = exposure unit
- HIF = human intake factor
- HQ = hazard quotient
- kg = kilogram
- L = liter
- m = meter
- mg = milligram
- NA = not available
- NC = non-cancer
- RBA = relative bioavailability
- RfC = reference concentration
- RfD = reference dose
- RME = reasonable maximum exposure
- SF = slope factor

TABLE 4-17**COMPARISON OF SOIL SAMPLES SIEVED TO 2 mm AND 250 µm***Bonita Peak Mining District*

Chemical	R ²	Ratio 2 mm:250 µm				
		Campground	Roadway	Waste Rock	All	Campground & Roadway
Aluminum	0.97	0.93	0.91	0.81	0.88	0.93
Antimony	0.87	0.86	0.86	1.00	0.90	0.82
Arsenic	1.0	0.79	0.77	0.77	0.77	0.78
Barium	0.93	0.90	0.78	0.80	0.81	0.83
Beryllium	0.19	0.91	0.88	1.77	1.17	0.88
Cadmium	0.97	0.89	0.70	1.32	0.92	0.75
Calcium	0.87	1.06	0.98	0.98	0.99	1.01
Chromium	0.63	0.82	0.80	0.77	0.80	0.80
Cobalt	0.86	0.92	0.88	0.99	0.92	0.90
Copper	0.96	0.89	0.74	0.81	0.78	0.76
Iron	0.99	0.87	0.90	0.75	0.85	0.91
Lead	0.98	0.86	0.80	0.77	0.80	0.77
Magnesium	0.95	1.04	1.06	0.94	1.02	1.08
Manganese	0.91	0.98	0.88	1.35	1.05	0.92
Mercury	0.81	0.99	0.96	0.70	0.88	0.97
Molybdenum	0.91	0.87	0.79	0.85	0.82	0.81
Nickel	0.74	0.91	0.87	0.78	0.85	0.88
Selenium	0.95	0.97	0.86	0.84	0.87	0.87
Silver	0.91	0.82	0.66	0.92	0.77	0.67
Thallium	0.98	0.85	0.82	0.92	0.85	0.81
Vanadium	0.86	0.91	0.87	0.87	0.87	0.88
Zinc	0.98	0.83	0.88	0.81	0.85	0.88

Notes:

& = and

µm = micron

mm = millimeter

TABLE 5-1
IEUBK INPUT PARAMETERS
Bonita Peak Mining District

Panel A. Age-Independent Values

Parameter	Value	Basis
Soil concentration (mg/kg)	EU-specific ^a	Mean of measured surface soil samples for EU. Background is set equal to 100 mg/kg (upland reference mean concentration).
Indoor dust concentration (mg/kg)	Cdust = 0.7*Csoil	EPA Region 8 Lead Strategy (EPA 2017)
Drinking water concentration (µg/L)	EU-specific ^a	Mean of measured surface water samples for EU. Background is set equal to 0.9 µg/L. ^b
Outdoor air concentration (µg/m ³)	0.1	IEUBK default (EPA 1994)
Indoor air concentration (µg/m ³)	30% of outdoors	IEUBK default (EPA 1994)
AF(water)	0.50	IEUBK default (EPA 1994)
AF(diet)	0.50	IEUBK default (EPA 1994)
RBA	0.54	Site-specific average campgrounds
AF(soil,dust)	0.27	AF(soil) = AF(water) x RBA
AF(air)	0.32	IEUBK default (EPA 1994)
Fraction of soil + dust that is soil	0.45	IEUBK default (EPA 1994)
GSD	1.6	IEUBK default (EPA 1994)
Maternal blood lead concentration (µg/dL)	0.6	EPA Region 8 Lead Strategy (EPA 2017f)

Panel B. Age-Dependent Values^b

Age	Air		Diet	Water	Residential Soil and Dust
	Time Outdoors (hours)	Ventilation Rate (m ³ /day)	Dietary Intake (µg lead/day)	Water Intake (L/day)	Total Intake (g/day)
0-1	1.0	3.22	2.66	0.4	0.086
1-2	2.0	4.97	5.03	0.43	0.094
2-3	3.0	6.09	5.21	0.51	0.067
3-4	4.0	6.95	5.58	0.54	0.063
4-5	4.0	7.68	5.64	0.57	0.067
5-6	4.0	8.32	6.04	0.6	0.052
6-7	4.0	8.89	5.95	0.63	0.055

Notes:

[a] $C(\text{adjusted}) = C(\text{site}) \cdot (EF/365) + C(\text{background}) \cdot (365-EF)/365$

[b] Values are based on EPA Region 8 Lead Strategy (EPA 2017).

[c] Values are based on the average of the geomean intake rates for boys and girls as reported in Child-Specific Exposure Factors Table 5-6. The geomean value for age 5-6 years old was assumed to be equal to the geomean for ages 4-5 years old.

µg/day = micrograms per day

µg/dL = micrograms per deciliter

µg/m³ = micrograms per cubic meter

AF = absorption fraction

Cdust = dust concentration

Csoil = soil concentration

EU = exposure unit

IEUBK = Integrated Exposure Uptake Biokinetic

L/day = liter per day

m³/day = cubic meter/day

mg/day = milligram per day

mg/kg = milligram per kilogram

NA = not available

RBA = relative bioavailability

TABLE 5-2
IN VITRO BIOACCESSIBILITY OF LEAD IN SITE SOIL SAMPLES
Bonita Peak Mining District

Sample Type	Sample Number	Lead Concentration (mg/kg)	IVBA (as fraction)	RBA* (as fraction)
Campground	A8M5-5872	3,273	0.55	0.45
	A8M5-5873	17,450	0.45	0.37
	A8M5-5874	61,037	0.71	0.59
	A8M5-5875	10,416	0.89	0.75
	Average			0.54
Roadway	MH1F62	71	0.40	0.32
	MH1F63	6,016	0.61	0.51
	MH1F64	1,896	0.23	0.18
	MH1F65	10,112	0.013	0
	MH1F66	151	0.10	0.06
	MH1F67	7,396	0.17	0.12
	Average			0.20
Waste Rock	MH1F68	13,283	0.051	0.02
	MH1F69	6,874	0.31	0.24
	MH1F70	6,537	0.30	0.23
	MH1F71	26,608	0.62	0.51
	MH1F72	1,976	0.19	0.14
	MH1F73	17,214	0.34	0.27
	MH1F74	10,947	0.086	0.05
	MH1F75	22,985	0.58	0.48
	MH1F76	5,904	0.61	0.51
	MH1F77	1,875	0.15	0.10
	MH1F78	3,633	0.093	0.05
	MH1F79	6,672	0.41	0.33
	MH1F80	4,401	0.15	0.11
	MH1F81	1,980	0.05	0.02
	MH1F82	7,278	0.09	0.05
	MH1F83	26,082	0.58	0.48
	MH1F84	27,946	0.62	0.51
	MH1F85	7,338	0.030	0
Average			0.23	

*RBA = 0.878 x IVBA - 0.028

Average across all media **0.27**

Notes:

IVBA = *In vitro* bioaccessibility

mg/kg = milligrams per kilogram

RBA = Relative bioavailability (*in vivo*)

TABLE 5-3
ADULT LEAD MODEL INPUT PARAMETERS
Bonita Peak Mining District

Basic Equations

$PbB(mother) = PbB0 + BKSf * \sum [Csitemedia * IRsitemedia * AFsitemedia * EF / 365]$

$PbB(fetus) = PbB(mother) * Ratio$

Parameter	Units	ATV Guide	ATV Rider	Camper (Dispersed)	Hiker				Fisherman		Hunter				Road Worker				Source	Notes
		EU5a	EU5b	EU7	EU1	EU2	EU3	EU4	EU8	EU9	EU1	EU2	EU3	EU4	EU1	EU2	EU3	EU4		
PbB0	µg/dL	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	NHANES 2009-2014	
BKSF	µg/dL per µg/day	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	USEPA 2003a	USEPA default recommendation
Ratio	µg/dL per µg/dL	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	USEPA 2003a	USEPA default recommendation
GSD	--	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	NHANES 2009-2014	
Soil Concentration	µg/g	337	1769	386	2607	2747	1616	1408			2607	2747	1616	1408	1724	2504	167	489	Site-specific	Mean, adjusted for fine/bulk fraction
Soil Ingestion Rate	g/day	0.100	0.100	0.100	0.050	0.050	0.050	0.050							0.165	0.165	0.165	0.165	Professional judgment	CTE exposure parameter
AF Soil	--	0.040	0.040	0.108	0.102	0.102	0.102	0.102			0.102	0.102	0.102	0.102	0.040	0.040	0.040	0.040	ALM Guidance (2003)	0.2 (default) * (site-specific RBA)
PEF	g/m ³		5.60E-04																Appendix C	
Riding time factor	unitless	0.5	0.5																Survey local guides/professional judgment	
Area Use factor	unitless	0.4	1																Survey local guides	
Breathing Rate	m ³ /hr	2.4	2.4												2.4	2.4	2.4	2.4	USEPA 1997	Mean breathing rate for moderate and heavy activities
Cair	µg/m ³	4.87E-01	estimated												2E-02	2E-02	7E-02	5E-03	Measured (Road Worker, ATV Guide); Estimated (ATV)	Mean for following rider
Exposure Time	hrs/day	4	4												6	6	6	6	Professional judgment	
AF Air	--	0.32	0.32												0.32	0.32	0.32	0.32	IEUBK default	
Csediment	µg/g			907					716	2152									Site-specific	Mean
IRsediment	g/day			0.100					0.050	0.050									Professional judgment	CTE exposure parameter
AF Sediment	--			0.108					0.108	0.108									ALM Guidance (2003)	0.2 (default) * 0.22 (site-specific RBA)
Cwater	µg/L			9.6					34	6.3									Site-specific	Mean
IR (drinking water)	L/day			1.4															Professional judgment	CTE exposure parameter
IR (incidental)	L/day			0.0021					0.0021	0.0021									Professional judgment	CTE exposure parameter
AF Water	--			0.20					0.20	0.20									ALM Guidance (2003)	
Cfish tissue	µg/g								0.037	0.022									Site-specific	Mean
IR Fish	g/day								1.2	1.2									Professional judgment	ingestion rate * fraction site
EF	days/year								350	350										
AF Fish	--								0.20	0.20									ALM Guidance (2003)	
Cdeer tissue	µg/g								0.012	0.012	0.012	0.012							Site-specific	Mean
IR Deer Tissue	g/day								16	16	16	16							Professional judgment	CTE exposure parameter
EF	days/year								350	350	350	350								
AF Deer Tissue	--								0.20	0.20	0.20	0.20							ALM Guidance (2003)	
Cgrouse tissue	µg/g								0.077	0.077	0.077	0.077							Site-specific	Mean
IR Grouse Tissue	g/day								8	8	8	8							Professional judgment	CTE exposure parameter
EF	days/year								350	350	350	350								
AF Grouse Tissue	--								0.20	0.20	0.20	0.20							ALM Guidance (2003)	
Exposure Frequency (all pathways, but fish/deer/grouse ingestion)	days/year	32	16	14	32	32	32	32	30	30	10	10	10	10	100	100	100	100	Professional judgment	CTE exposure parameter

Notes:

Cells shaded grey indicate the pathway is incomplete for the receptor.

- µg = microgram
- AF = absorption fraction
- ATV = all terrain vehicle
- BKSF = biokinetic slope factor
- C = concentration
- CTE = central tendency exposure
- dL = deciliter
- EF = exposure frequency
- EU = exposure unit
- g = gram
- GSD = geometric standard deviation
- hr = hour
- IEUBK = Integrated Exposure Uptake Biokinetic Model
- IR = ingestion rate
- L = liter
- m³ = cubic meter
- NHANES = National Health and Nutrition Examination Survey
- PbB = blood lead level
- PbB0 = baseline blood lead level
- PEF = particulate emission factor
- RBA = relative bioavailability
- USEPA = United States Environmental Protection Agency

TABLE 5-4
EVALUATION OF RISK FROM LEAD USING THE IEUBK MODEL
Bonita Peak Mining District

EU/Receptor		Adjusted ^[a,b] Soil Conc (mg/kg)	Adjusted ^[a] Water Conc (µg/L)	Probability Distribution (% Above Target Blood Lead)		
				Target Blood Lead 5 µg/dL	Target Blood Lead 8 µg/dL	Target Blood Lead 10 µg/dL
EU6	Camper - Campground	103	0.88	1	0.05	0.008
EU7	Camper - Dispersed	418	1.2	22	4	1

[a] $C(\text{adjusted}) = C(\text{site}) \cdot (EF/365) + C(\text{background}) \cdot (365-EF)/365$

[b] bulk soil concentration was adjusted based on the bulk/fine regression

C = concentration

EF = exposure frequency

IEUBK = Integrated Exposure Uptake Biokinetic

µg/dL = micrograms per deciliter

µg/L = micrograms per liter

mg/kg = milligram per kilogram

% = percent

 greater than 5%

**TABLE 5-5
EVALUATION OF RISK FROM LEAD USING THE ADULT LEAD MODEL**

Bonita Peak Mining District

Panel A. Recreational Receptors

Parameter	ATV Guide	ATV Rider	Camper (Dispersed)	Hiker				Fisherman		Hunter			
	EU5a	EU5b	EU7	EU1	EU2	EU3	EU4	EU8	EU9	EU1	EU2	EU3	EU4
GM PbB(mother) (µg/dL)	0.66	0.75	0.9	1.07	1.09	0.89	0.85	0.73	0.98	0.7	0.7	0.7	0.7
mu	-0.419	-0.287	-0.16	0.063	0.09	-0.12	-0.16	-0.31	-0.016	-0.4	-0.4	-0.4	-0.4
sigma	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59
P10 (fetus)	0.00008%	0.0002%	0.0006%	0.003%	0.004%	0.0009%	0.0006%	0.0002%	0.002%	0.00008%	0.00008%	0.00008%	0.00008%
P8 (fetus)	0.0005%	0.001%	0.003%	0.02%	0.02%	0.004%	0.003%	0.001%	0.009%	0.0005%	0.0005%	0.0005%	0.0005%
P5 (fetus)	0.01%	0.03%	0.07%	0.2%	0.3%	0.09%	0.1%	0.03%	0.2%	0.01%	0.01%	0.01%	0.01%

Panel B. Occupational Receptors

Parameter	Road Worker				
	EU1	EU2	EU3	EU4	All [a]
GM PbB(mother) (µg/dL)	1.86	2.42	0.76	0.96	
mu	0.62	0.88	-0.277	-0.05	
sigma	0.59	0.59	0.59	0.59	
P10 (fetus)	0.1%	0.5%	0.0002%	0.002%	0.1%
P8 (fetus)	0.4%	1%	0.001%	0.01%	0.4%
P5 (fetus)	3%	8%	0.04%	0.1%	3%

[a] = Area-weighted values are based on an assumed approximate road length (in miles) of 6 for EU1, 7 for EU2, 8 for EU3, 7.5 for EU4.

µg/dL = micrograms per deciliter

EU = exposure unit

GM = geometric mean

PbB = blood lead level

TWA = time-weighted average

greater than 5%

TABLE 5-6
EVALUATION OF RISK FROM LEAD USING THE ADULT LEAD MODEL FOR INDIVIDUAL DISPERSED CAMPSITES
Bonita Peak Mining District

Basic Equations

$$PbB(\text{mother}) = PbB0 + BKS F \cdot \sum [C(\text{site media}) \cdot IR(\text{site media}) \cdot AF(\text{site media}) \cdot EF / 365]$$

$$PbB(\text{fetus}) = PbB(\text{mother}) \cdot \text{Ratio}$$

Parameter	Units	CMP2	CMP3	CMP4	CMP5	CMP7	CMP8	CMP9	CMP10	CMP11	CMP12	CMP13	CMP15	CMP15A	Source	Notes
PbB0	µg/dL	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	NHANES 2009-2014	
BKSF	µg/dL per µg/day	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	USEPA 2003a	USEPA default recommendation
Ratio	µg/dL per µg/dL	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	USEPA 2003a	USEPA default recommendation
GSD	--	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	NHANES 2009-2014	
Soil Concentration	µg/g	3592	33086	62499	200	12254	1919	1935	74	474	257	100	635	1010	Campsite-specific	Mean, adjusted for fine/bulk fraction ^[b]
Csoil/Bkg	µg/g	66	66	66	66	66	66	66	66	66	66	66	66	66	Site-specific	Mean
Soil Ingestion Rate	g/day	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	Professional judgment	CTE exposure parameter
RBA	--	0.45	0.37	0.59	0.54	0.75	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	Site-specific	Location-specific or average
AF Soil	--	0.09	0.074	0.118	0.11	0.15	0.11	0.108	0.11	0.11	0.11	0.11	0.11	0.11	ALM Guidance (2003)	0.2 (default) * (site-specific RBA) ^[b]
Csediment	µg/g	907	907	907	907	907	907	907	907	907	907	907	907	907	Site-specific	Mean
IRsediment	g/day	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	Professional judgment	CTE exposure parameter
AF Sediment	--	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108	ALM Guidance (2003)	0.2 (default) * 0.22 (site-specific RBA)
Cwater	µg/L	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	Site-specific	Mean
IR (drinking water)	L/day	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	Professional judgment	CTE exposure parameter
IR (incidental)	L/day	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	Professional judgment	CTE exposure parameter
AF Water	--	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	ALM Guidance (2003)	
Exposure Frequency	days/year	14	14	14	14	14	14	14	14	14	14	14	14	14	Professional judgment	CTE exposure parameter

Parameter	Units	CMP2	CMP3	CMP4	CMP5	CMP7	CMP8	CMP9	CMP10	CMP11	CMP12	CMP13	CMP15	CMP15A
GM PbB(mother)	µg/dL	1.290	4.555	12.130	0.825	3.614	1.110	1.113	0.804	0.870	0.834	0.808	0.897	0.959
mu		0.254	1.516	2.496	-0.192	1.285	0.105	0.107	-0.218	-0.139	-0.181	-0.213	-0.109	-0.041
sigma		0.588	0.588	0.588	0.588	0.588	0.588	0.588	0.588	0.588	0.588	0.588	0.588	0.588
P10 (fetus)		0.01%	6%	56%	0.0005%	3%	0.004%	0.00%	0.0004%	0.001%	0.0005%	0.0004%	0.001%	0.002%
P8 (fetus)		0.1%	13%	70%	0.003%	6%	0.02%	0.02%	0.002%	0.004%	0.003%	0.002%	0.005%	0.008%
P5 (fetus)		1%	37%	91%	0.06%	23%	0.3%	0%	0.05%	0.08%	0.06%	0.05%	0.1%	0.1%

Notes:

[a] Campsite-specific RBA was used in calculations when available; the average RBA across campsites was used when a campsite-specific value was not available.

[b] CMP10 and CMP13 the bulk fraction concentration was not adjusted to be based on the fine fraction using the regression because it would result in a negative concentration.

- µg = microgram
- AF = absorption fraction
- BKSF = biokinetic slope factor
- C = concentration
- CTE = central tendency exposure
- dL = deciliter
- EF = exposure frequency
- g = gram
- GM = geometric mean
- GSD = geometric standard deviation
- hr = hour
- IEUBK = Integrated Exposure Uptake Biokinetic Model
- IR = ingestion rate
- m³ = cubic meter
- NHANES = National Health and Nutrition Examination Survey
- PbB = blood lead level
- PbB0 = baseline blood lead level
- PEF = particulate emission factor
- RBA = relative bioavailability
- USEPA = United States Environmental Protection Agency

TABLE 5-7
STATISTICAL COMPARISON OF SITE AND BACKGROUND DATASETS FOR LEAD
Bonita Peak Mining District

Media Type	Background Data Source	EU	p value	Conclusion with Alpha 0.05
Soil	Site-Specific Upland Reference Soil Samples	EU5a - Roadway Soil in the Alpine Loop	1	Do Not Reject H0, Conclude Sample 1 >= Sample 2
		EU1-4, EU5b - All Roadway Soil	1	Do Not Reject H0, Conclude Sample 1 >= Sample 2
	Smith et al.	EU5a - Roadway Soil in the Alpine Loop	1	Do Not Reject H0, Conclude Sample 1 >= Sample 2
		EU1-4, EU5b - All Roadway Soil	1	Do Not Reject H0, Conclude Sample 1 >= Sample 2

Smith, D.B., Cannon, W.F., Woodruff, L.G., Solano, Federico, Kilburn, J.E., and Fey, D.L. 2013. Geochemical and mineralogical data for soils of the conterminous United States: U.S. Geological Survey Data Series 801, 19 p., <https://pubs.usgs.gov/ds/801/>. State of Colorado, restricted to forested upland locations.

Notes:

Form 2 (Sample 1 = Site, Sample 2 = Reference)

H0: Mean/Median of Sample 1 >= Mean/Median of Sample 2

">=" = greater than or equal to

ATV = all terrain vehicle

COPC = chemical of potential concern

EU = exposure unit

H0 = null hypothesis

vs. = versus

TABLE 5-8
EVALUATION OF RISK FOR THE ROAD WORKER FROM LEAD USING THE ADULT LEAD MODEL FOR BACKGROUND DATASETS
Bonita Peak Mining District

Basic Equations

$PbB(\text{fetus}) = PbB(\text{mother}) * \text{Ratio}$

$PbB(\text{mother}) = PbB0 + BKSF * \sum [Cs(\text{media}) * IR(\text{media}) * AF(\text{media}) * EF / 365]$

Parameter	Units	Road Worker (soil only)	Source	Notes
PbB0	µg/dL	0.6	NHANES 2009-2014	
BKSF	µg/dL per µg/day	0.4	USEPA 2003a	USEPA default recommendation
Ratio	µg/dL per µg/dL	0.9	USEPA 2003a	USEPA default recommendation
GSD	--	1.8	NHANES 2009-2014	
Csoil	µg/g	100	Site-specific	Mean
IRsoil	g/day	0.165	Professional judgment	CTE exposure parameter
AFsoil	--	0.044	ALM Guidance (2003)	0.2 (default) * 0.22 (site-specific RBA)
PEF	g/m ³		Appendix C	
Riding time factor	unitless		Professional judgment	
Area use factor	unitless		Professional judgment	
BR	m ³ /hr	2.4	USEPA 1997	Mean breathing rate for moderate and heavy activities
Cair	µg/m ³	2E-02	Site-specific (road worker); Estimated (ATV Rider)	Mean
ET	hrs/day	6	Professional judgment	
AFair	--	0.32	IEUBK default	
Csed/Site	µg/g		Site-specific	Mean
IRsed	g/day		Professional judgment	CTE exposure parameter
AFsed	--		IEUBK default soil	0.2 (default) * 0.25 (RBA)
CwaterSite	µg/L		Site-specific	Mean
IRwater (drinking water)	L/day		Professional judgment	CTE exposure parameter
IRwater (incidental)	L/day		Professional judgment	CTE exposure parameter
AFwater	--			Assumes same ratio of AF(water) to AF(soil) as IEUBK
Cfish	µg/g		Site-specific	Mean
IRFish	g/day		Professional judgment	ingestion rate * fraction site
Exposure Freq	days/year			
AFFish	--		ALM Guidance (2003)	
Exposure Frequency (all pathways, but fish ingestion)	days/year	100	Professional judgment	CTE exposure parameter

Parameter	Units	Road Worker
GM PbB(mother) (µg/dL)	µg/dL	0.690
mu		-0.371
sigma		0.588
P10 (fetus)		0.00011%
P8 (fetus)		0.0007%
P5 (fetus)		0.02%

Notes:

Cells shaded grey indicate the pathway is incomplete for the receptor

µg = microgram

AF = absorption fraction

BKSF = biokinetic slope factor

C = concentration

CTE = central tendency exposure

dL = deciliter

EF = exposure frequency

g = gram

GM = geometric mean

GSD = geometric standard deviation

hr = hour

IEUBK = Integrated Exposure Uptake Biokinetic Mode

IR = ingestion rate

m³ = cubic meter

NHANES = National Health and Nutrition Examination Survey

PbB = blood lead level

PbB0 = baseline blood lead level

PEF = particulate emission factor

RBA = relative bioavailability

USEPA = United States Environmental Protection Agency

TABLE 6-1
ACUTE LEAD SCREENING LEVELS
Bonita Peak Mining District

Panel A. Dispersed Campsite Soil (RBA = 0.54)

Scenario	2-Day Exposure	14-Day Exposure
Scenario 1	2,594	1,331
Scenario 2	596	306

Panel B. Waste Rock (RBA = 0.23)

Scenario	2-Day Exposure	14-Day Exposure
Scenario 1	6,090	3,125
Scenario 2	1,400	719

Notes:

mg/kg = milligrams per kilogram

RBA = relative bioavailability

TABLE 6-2
ACUTE ARSENIC SCREENING LEVELS
Bonita Peak Mining District

Panel A. Dispersed Campsite Soil (RBA = 0.07)

Scenario	2-Day Exposure	14-Day Exposure
Scenario 1	1,216	174
Scenario 2	280	40

Panel B. Waste Rock (RBA = 0.05)

Scenario	2-Day Exposure	14-Day Exposure
Scenario 1	1,703	243
Scenario 2	393	56

Notes:

mg/kg = milligrams per kilogram

RBA = relative bioavailability

Figures

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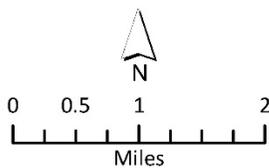
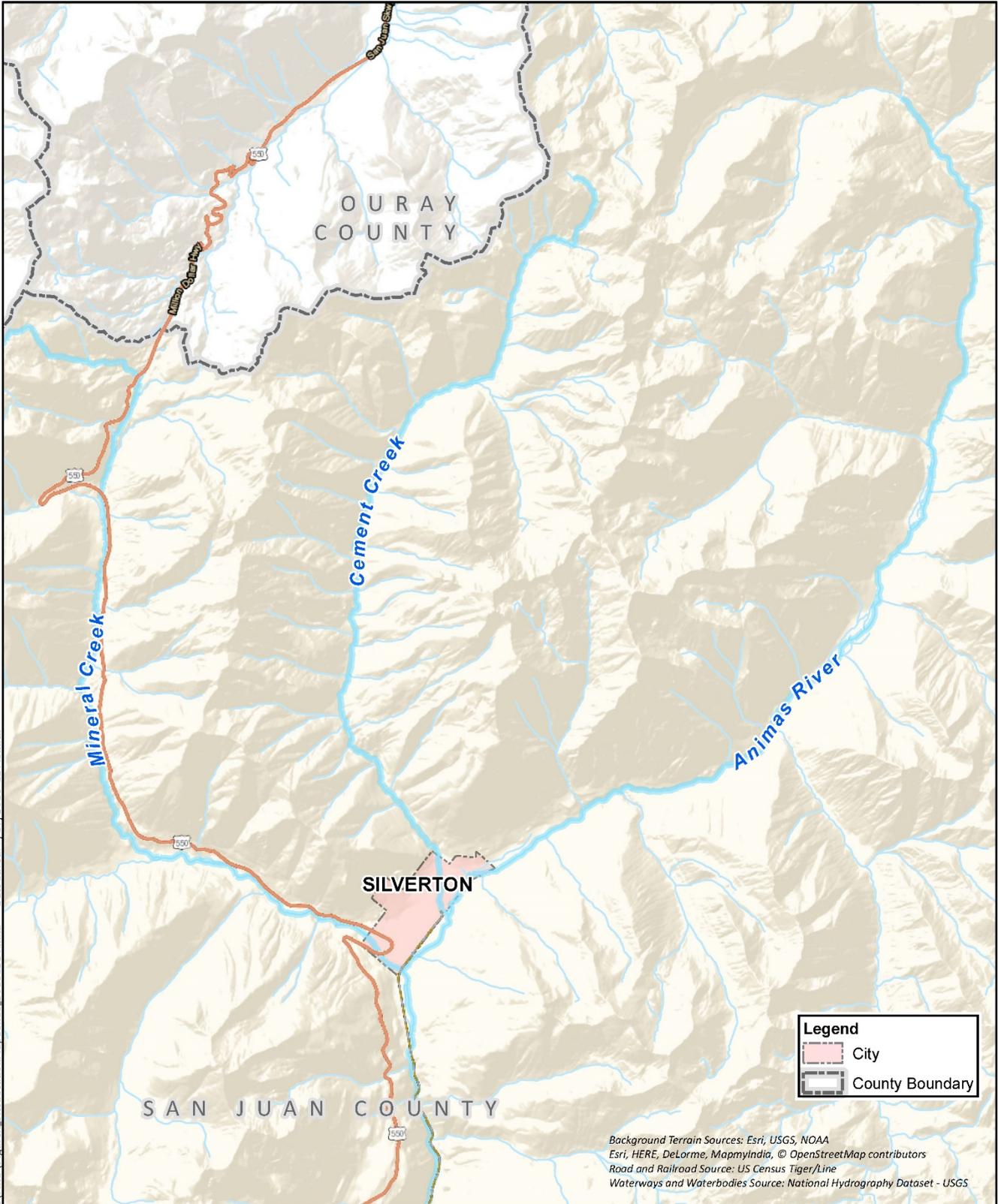
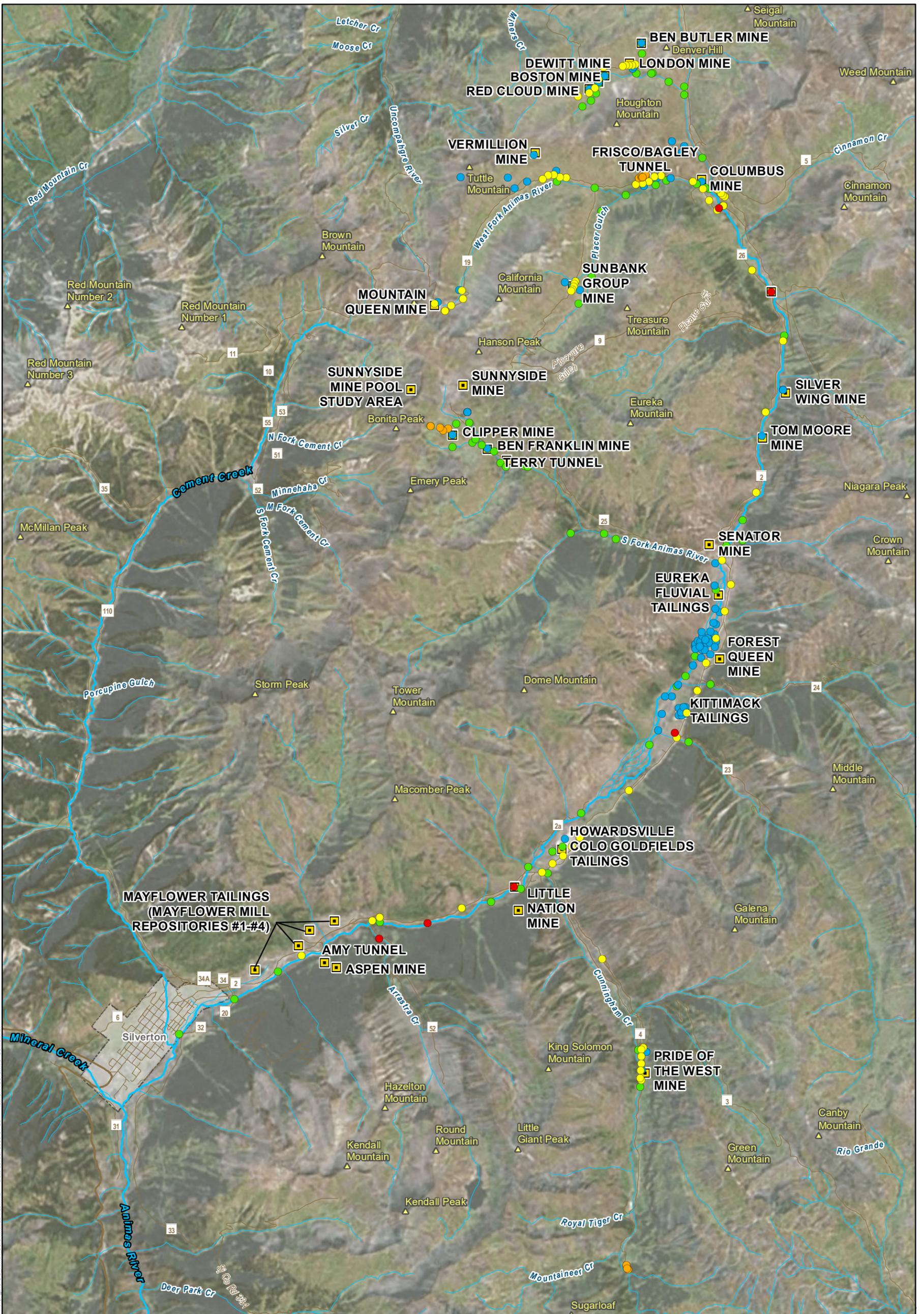
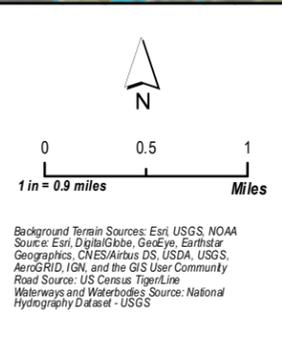
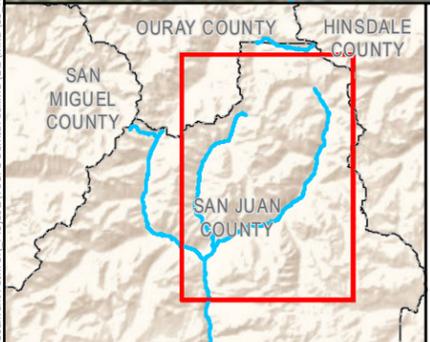


Figure 2-1
Site Location Map
Bonita Peak Mining District | San Juan County, CO





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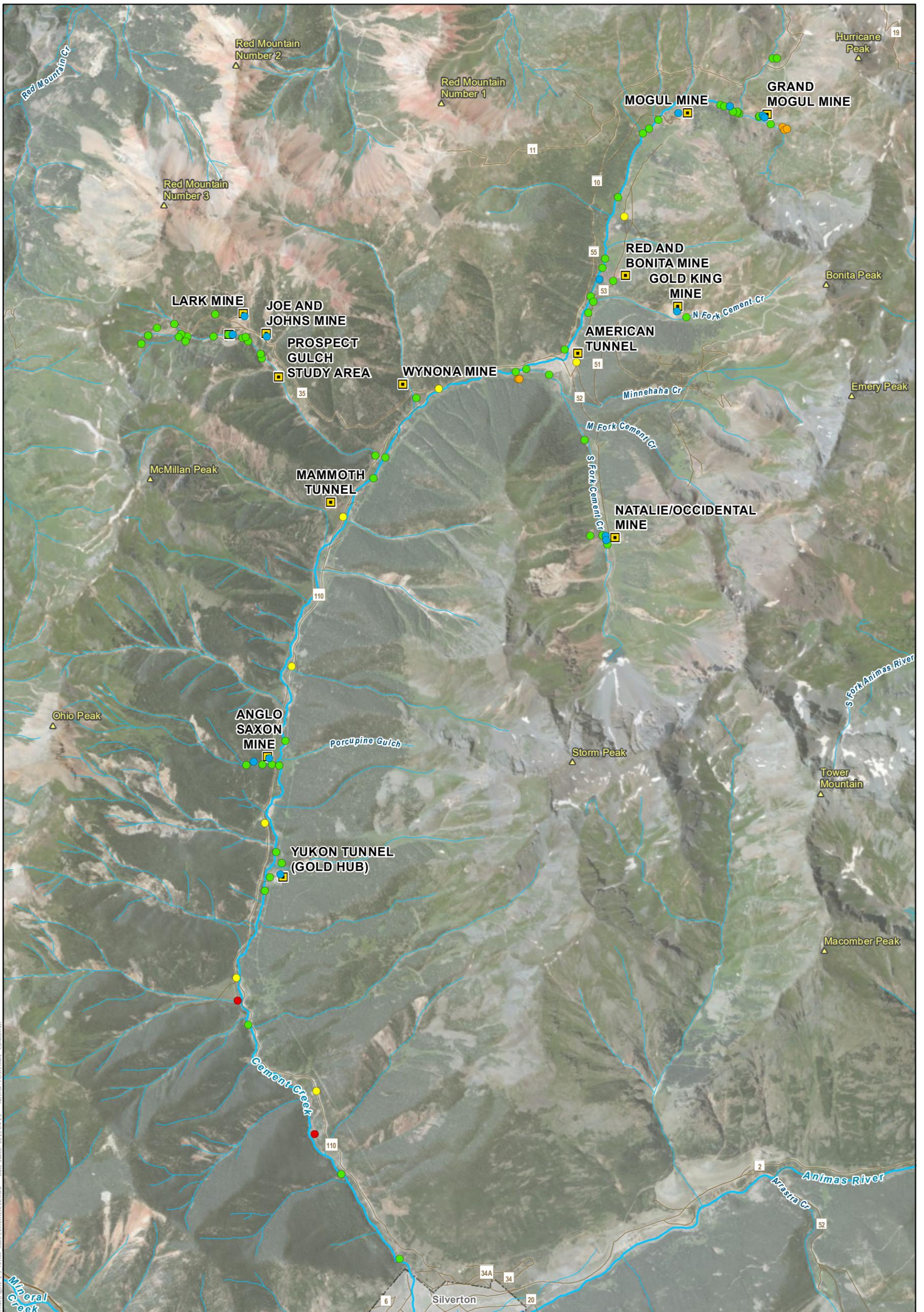


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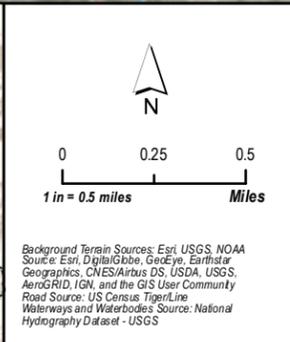
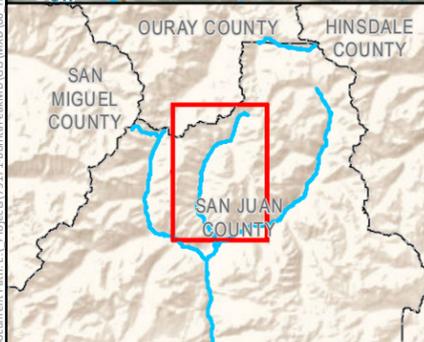
● Campground Soil	--- Forest Service Road
● Overbank Soil	— Road
● Upland Reference Soil	— Highway
● Roadway Soil	~ Streams
● Waste Rock/Floodplain Soil	
■ Mine Location	
▲ Mountain Peak	
□ County Road	

Figure 2-2
 Soil Media Sample Locations in the Animas River Watershed Area
 Bonita Peak Mining District Superfund Site | San Juan County, CO
 Human Health Risk Assessment





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Background Terrain Sources: Esri, USGS, NOAA
 Source: Esri, DigitalGlobe, GeoEye, Earthstar
 Geographics, CNES/Airbus DS, USDA, USGS,
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 Road Source: US Census TigerLine
 Waterways and Waterbodies Source: National
 Hydrography Dataset - USGS

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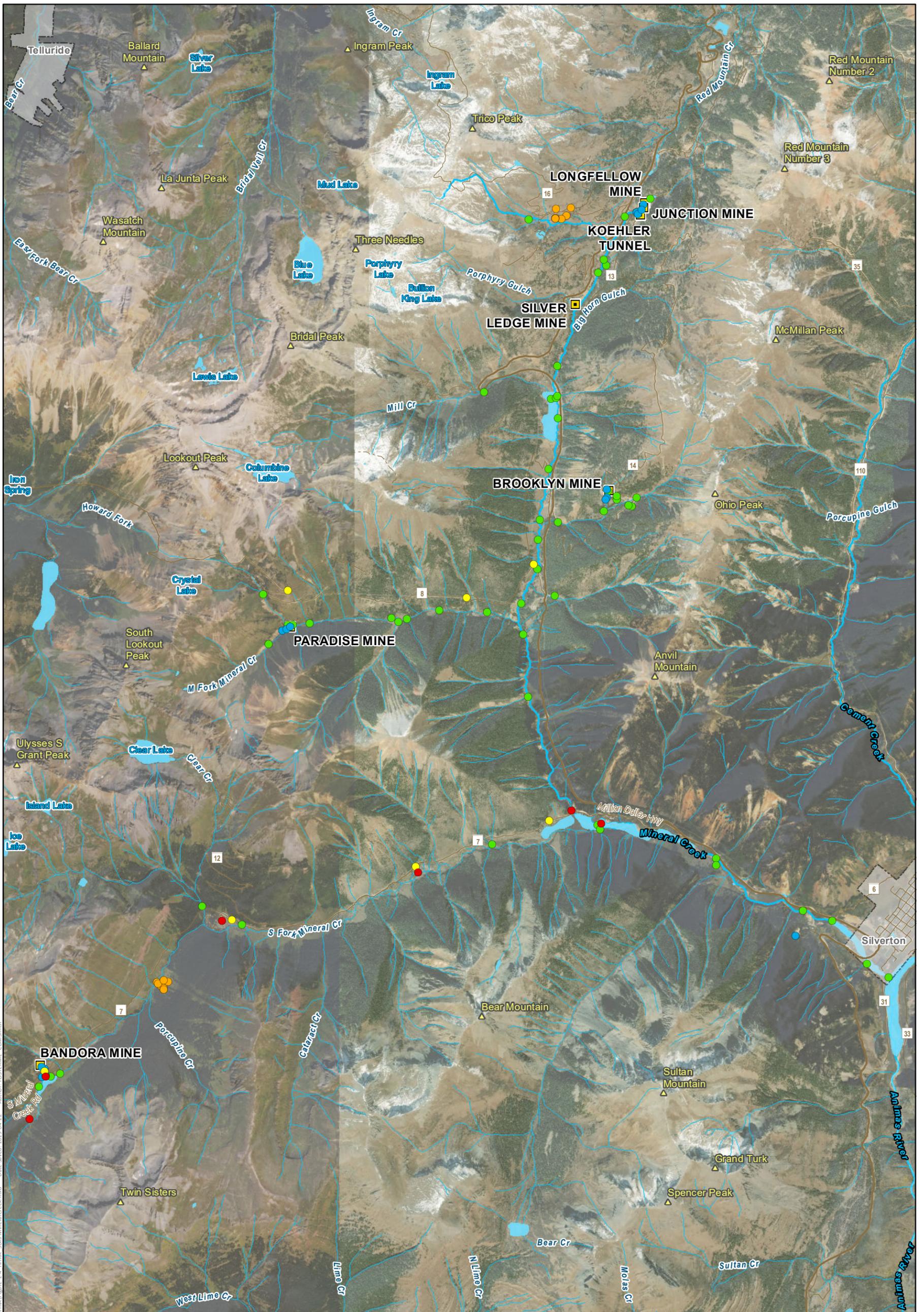
Soil Locations

- Campground Soil
- Overbank Soil
- Upland Reference Soil
- Roadway Soil
- Waste Rock/Floodplain Soil
- Mine Location
- ▲ Mountain Peak
- County Road

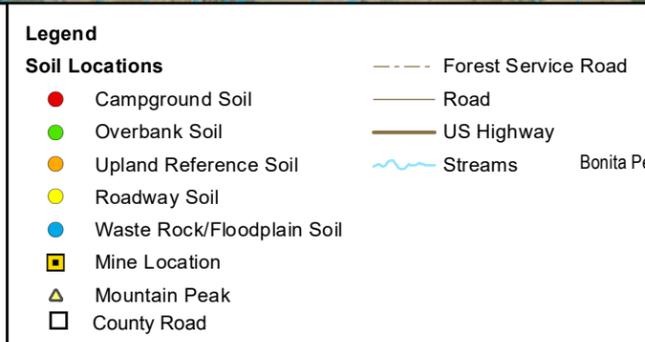
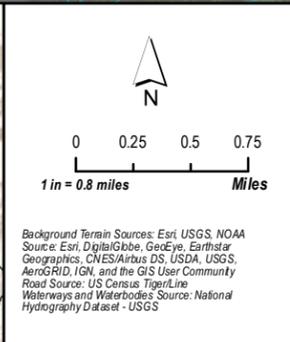
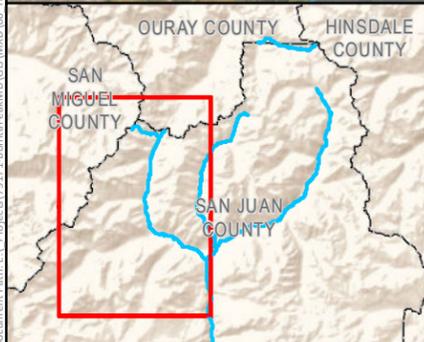
— Road
 — Highway
 ~~~~~ Streams

**Figure 2-3**  
 Soil Media Sample Locations in the  
 Cement Creek Watershed Area

Bonita Peak Mining District Superfund Site | San Juan County, CO  
 Human Health Risk Assessment

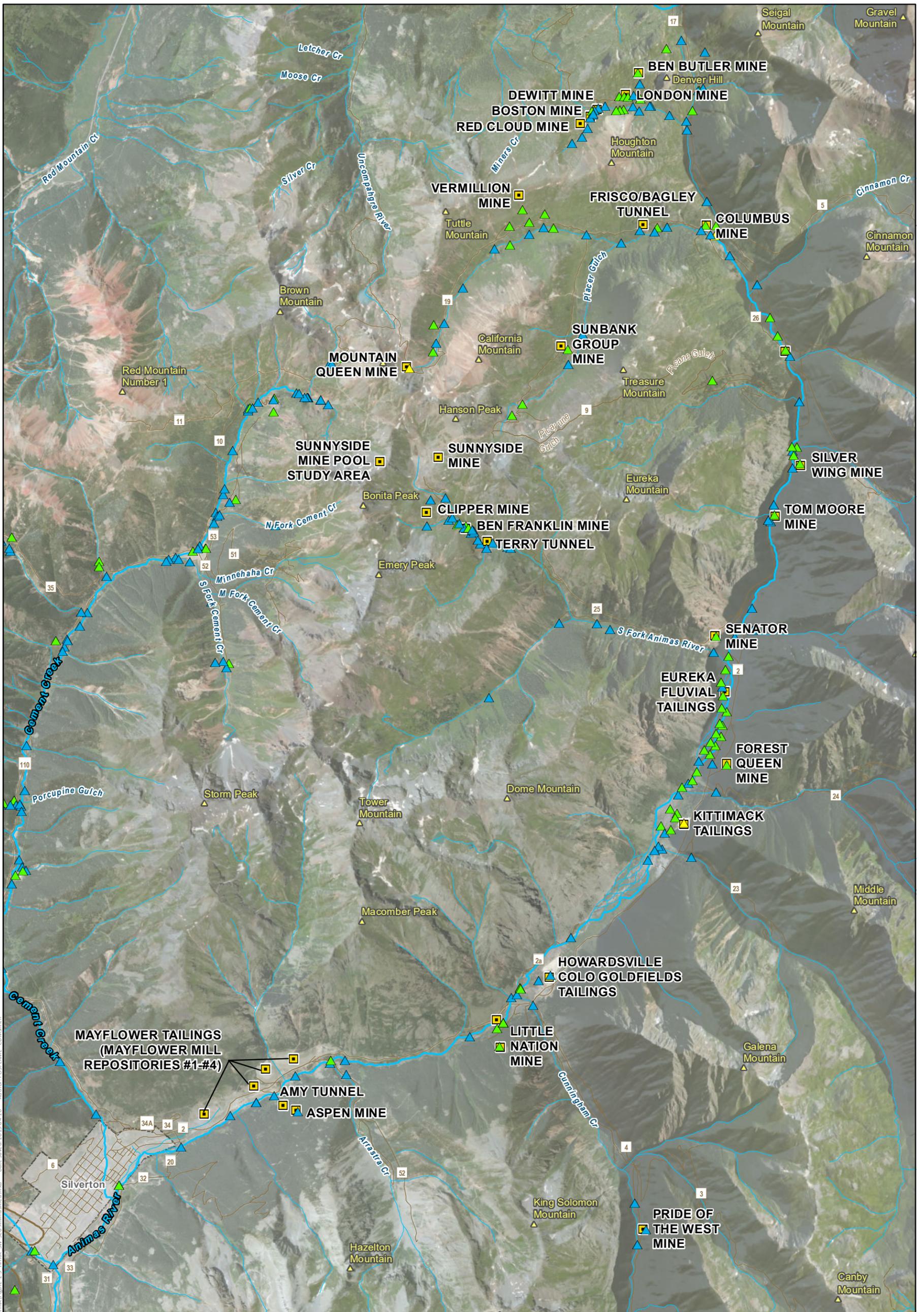


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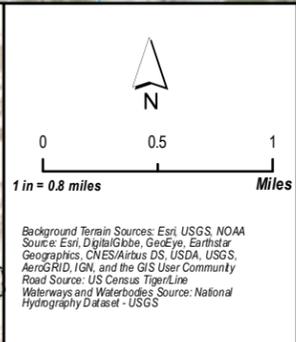
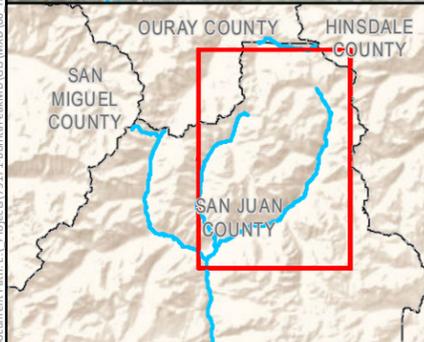


**Figure 2-4**  
 Soil Media Sample Locations in the Mineral Creek Watershed Area  
 Bonita Peak Mining District Superfund Site | San Juan County, CO  
 Human Health Risk Assessment





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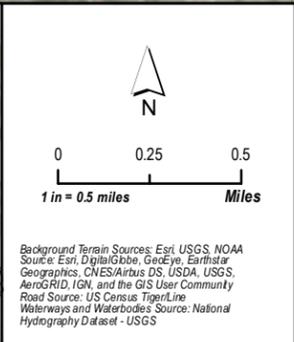
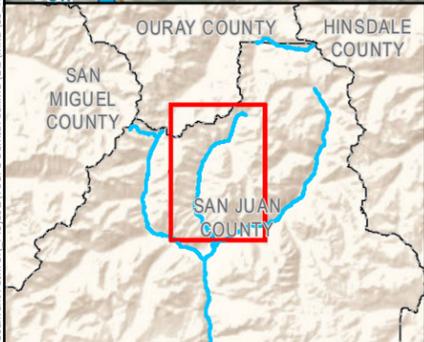
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| <span style="color: yellow;">▲</span> Sediment                                                                  | Road           |
| <span style="color: blue;">▲</span> Surface Water/Sediment                                                      | Road           |
| <span style="border: 1px solid yellow; display: inline-block; width: 10px; height: 10px;"></span> Mine Location | Highway        |
| <span style="color: yellow;">▲</span> Mountain Peak                                                             | Streams        |
| <span style="border: 1px solid black; display: inline-block; width: 10px; height: 10px;"></span> County Road    |                |

**Figure 2-5**  
 Surface Water/Sediment Sample Locations in the  
 Animas River Watershed Area

Bonita Peak Mining District Superfund Site | San Juan County, CO  
 Human Health Risk Assessment



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**Legend**

**Sample Location**

- ▲ Surface Water
- ▲ Sediment
- ▲ Surface Water/Sediment
- Mine Location
- ▲ Mountain Peak
- County Road

— Road  
 — Highway  
 ~~~~~ Streams

Figure 2-6
 Surface Water/Sediment Sample Locations in the
 Cement Creek Watershed Area

Bonita Peak Mining District Superfund Site | San Juan County, CO
 Human Health Risk Assessment



Figure 2-7
Surface Water/Sediment Sample Locations
 in the Mineral Creek Watershed Area
 Bonita Peak Mining District Superfund Site | San Juan County, CO
 Human Health Risk Assessment

Legend

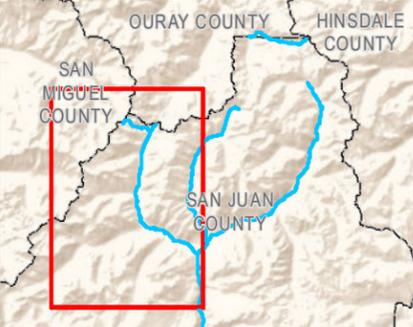
Sample Location

- ▲ Surface Water
- ▲ Surface Water/Sediment
- Mine Location
- ▲ Mountain Peak
- County Road

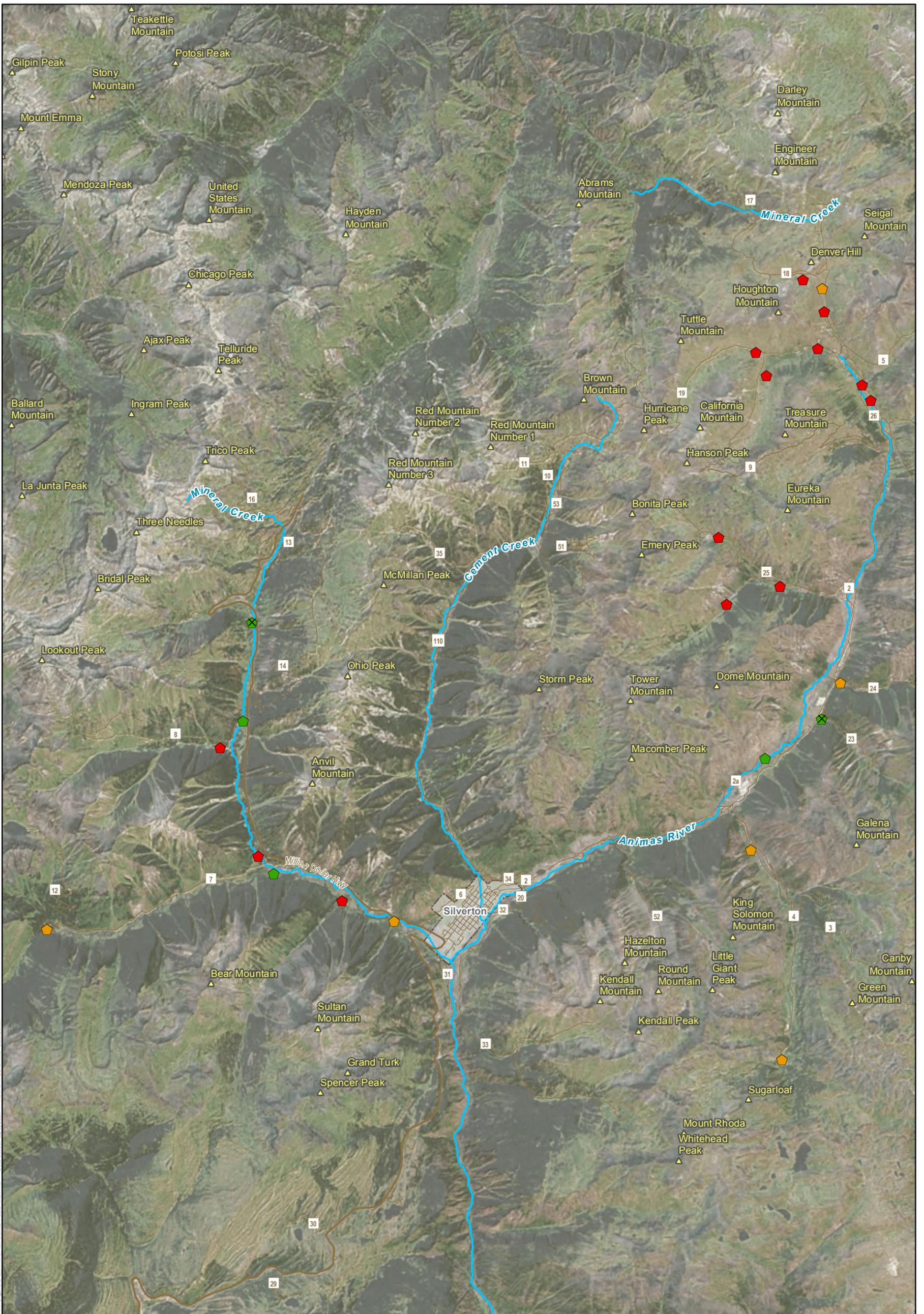
- Forest Service Road
- Road
- US Highway
- ~ Streams

0 0.25 0.5 0.75
 1 in = 0.8 miles Miles

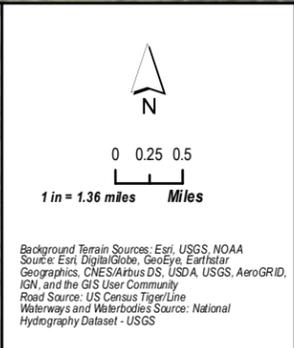
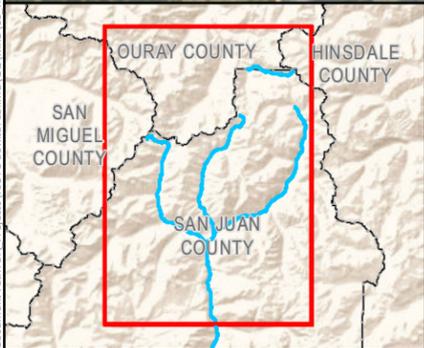
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 Geographics, CNES/Airbus DS, USDA, USGS,
 AeroGRID, IGN, and the GIS User Community
 Road Source: US Census Tiger/Line
 Waterways and Watersheds Source: National
 Hydrography Dataset - USGS



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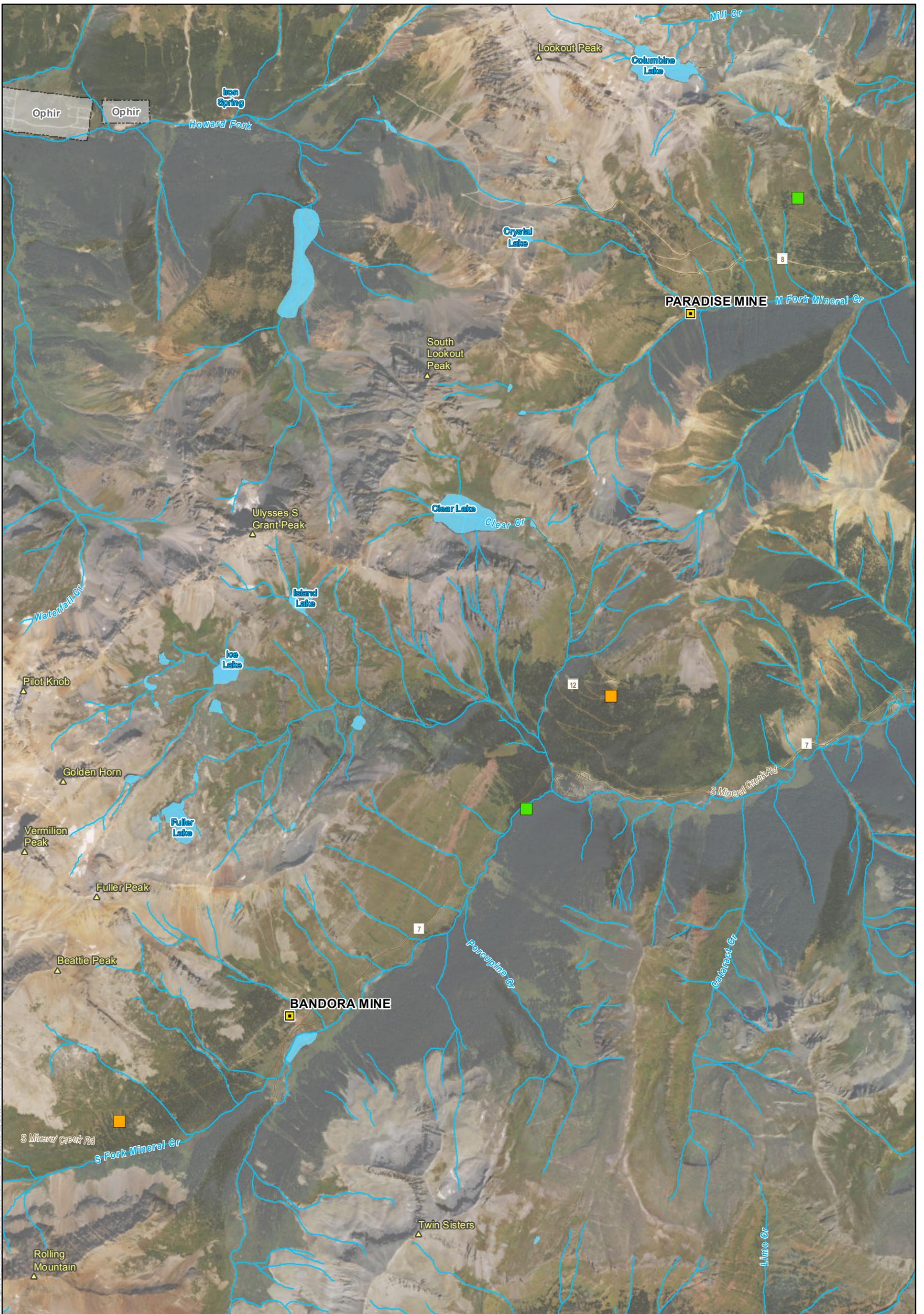


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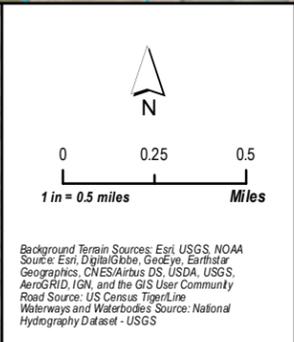
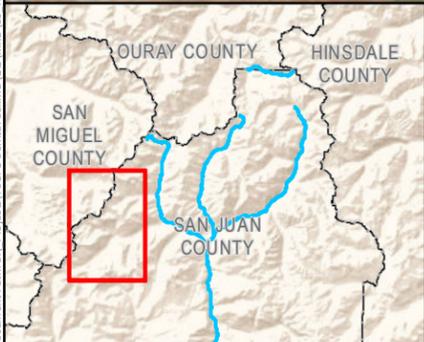


| Legend | |
|--|--|
| Fish Sample Locations | |
| ◆ Fish captured and tissue collected | ▲ Mountain Peak |
| ▭ Fish captured and tissue not collected | - - - Forest Service Road |
| ▭ Fish not captured | — Road |
| X Reference Location | — Highway |
| | ~ Streams |
| | □ County Road |

Figure 2-8
Fish Sample Locations
 Bonita Peak Mining District Superfund Site | San Juan County, CO
 Human Health Risk Assessment



Document Path: E:\Projects\79171_Bonita Peak\GIS\MXD\06_HHRA\Figure 2-9_HHRA_Game-Bonita-Peaks-MD.MXD Date Saved: 12/17/2017 Author: FOSTERML CDM Smith



Background Terrain Sources: Esri, USGS, NOAA
 Source: Esri, DigitalGlobe, GeoEye, Earthstar
 Geographics, CNES/Airbus DS, USDA, USGS,
 AeroGRID, IGN, and the GIS User Community
 Road Source: US Census Tiger/Line
 Waterways and Waterbodies Source: National
 Hydrography Dataset - USGS

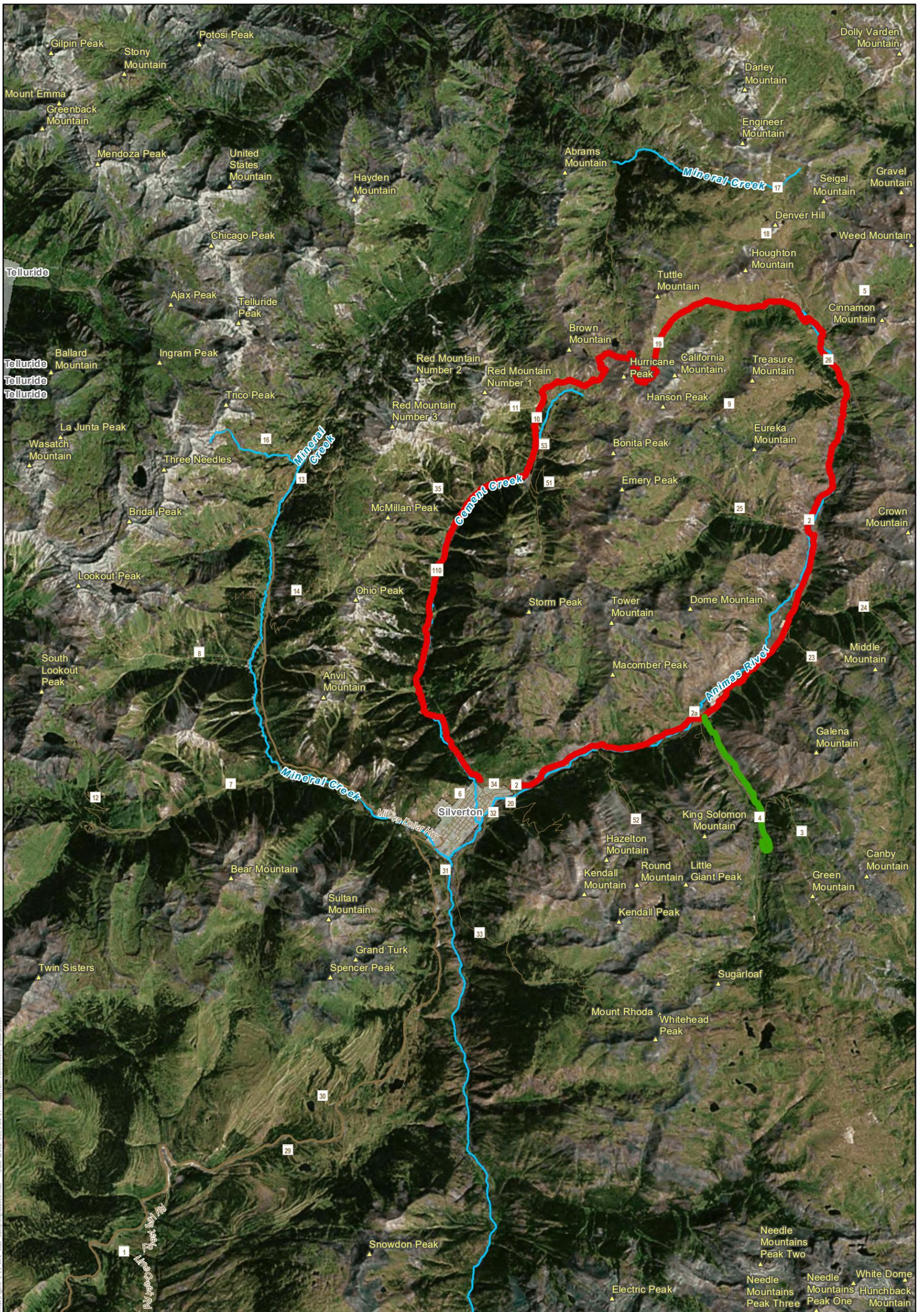
Legend

Game Sample Locations

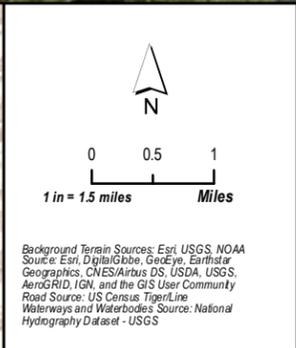
- Deer Tissue
- Grouse Tissue
- Mine Location
- ▲ Mountain Peak
- Forest Service Road
- Road
- ~ Streams
- County Road

Figure 2-9
Game Sample Locations
 Bonita Peak Mining District Superfund Site | San Juan County, CO
 Human Health Risk Assessment

CDM Smith



Document Path: E:\Projects\79171_Bonita Peak\GIS\MXD\06_HHBA\Figure_2-11_ATV_ABS_SamplingRoutes.mxd
 Date Saved: 2015-04-17
 Author: FOSTER, R.M. - CDM Smith

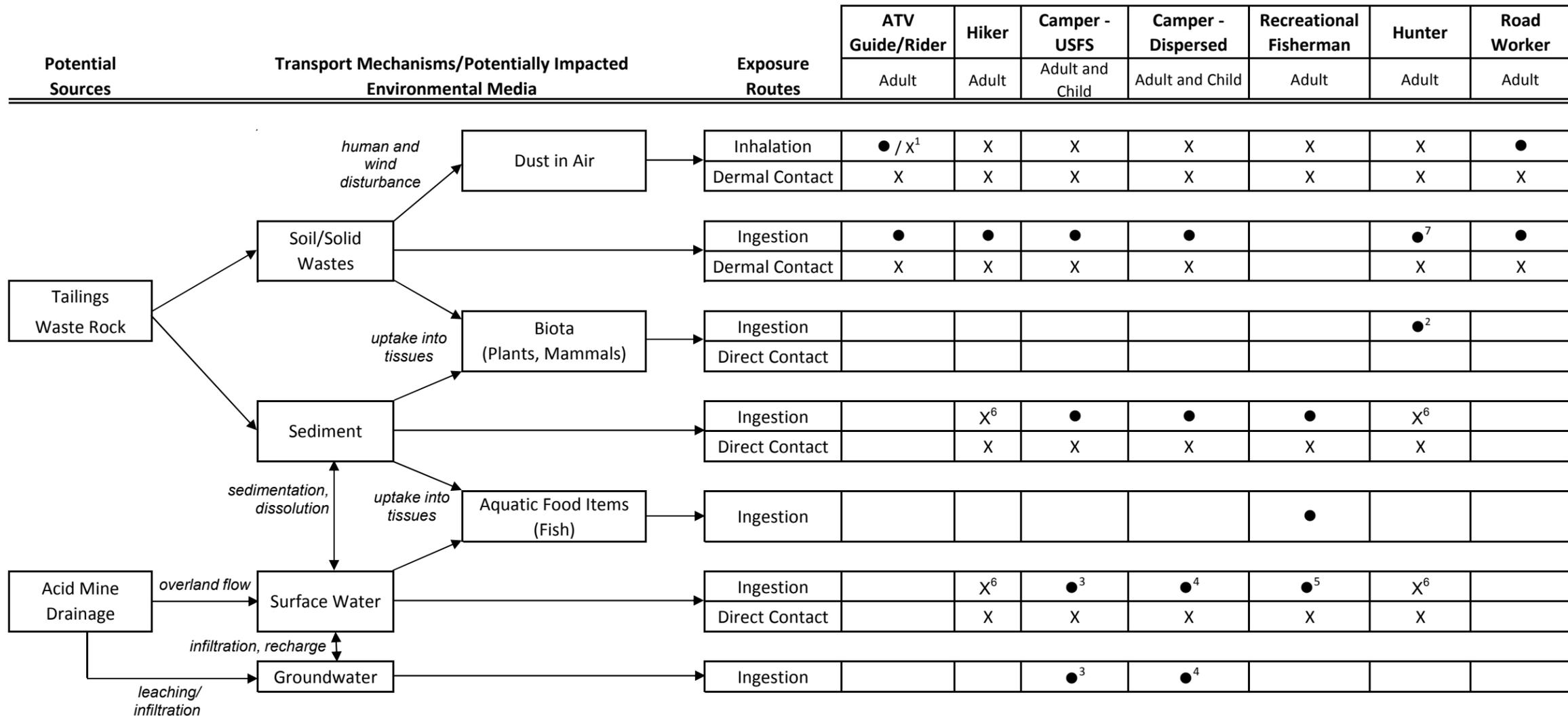


- Legend**
- ▲ Mountain Peak
 - ATV ABS Route – Alpine Loop
 - ATV ABS Route - Remote Roadway
 - - - Forest Service Road
 - Road
 - Highway
 - County Road

Figure 2-11
 ATV ABS Sampling Routes

Bonita Peak Mining District Superfund Site | San Juan County, CO
 Human Health Risk Assessment

FIGURE 3-1
CONCEPTUAL SITE MODEL
Bonita Peak Mining District



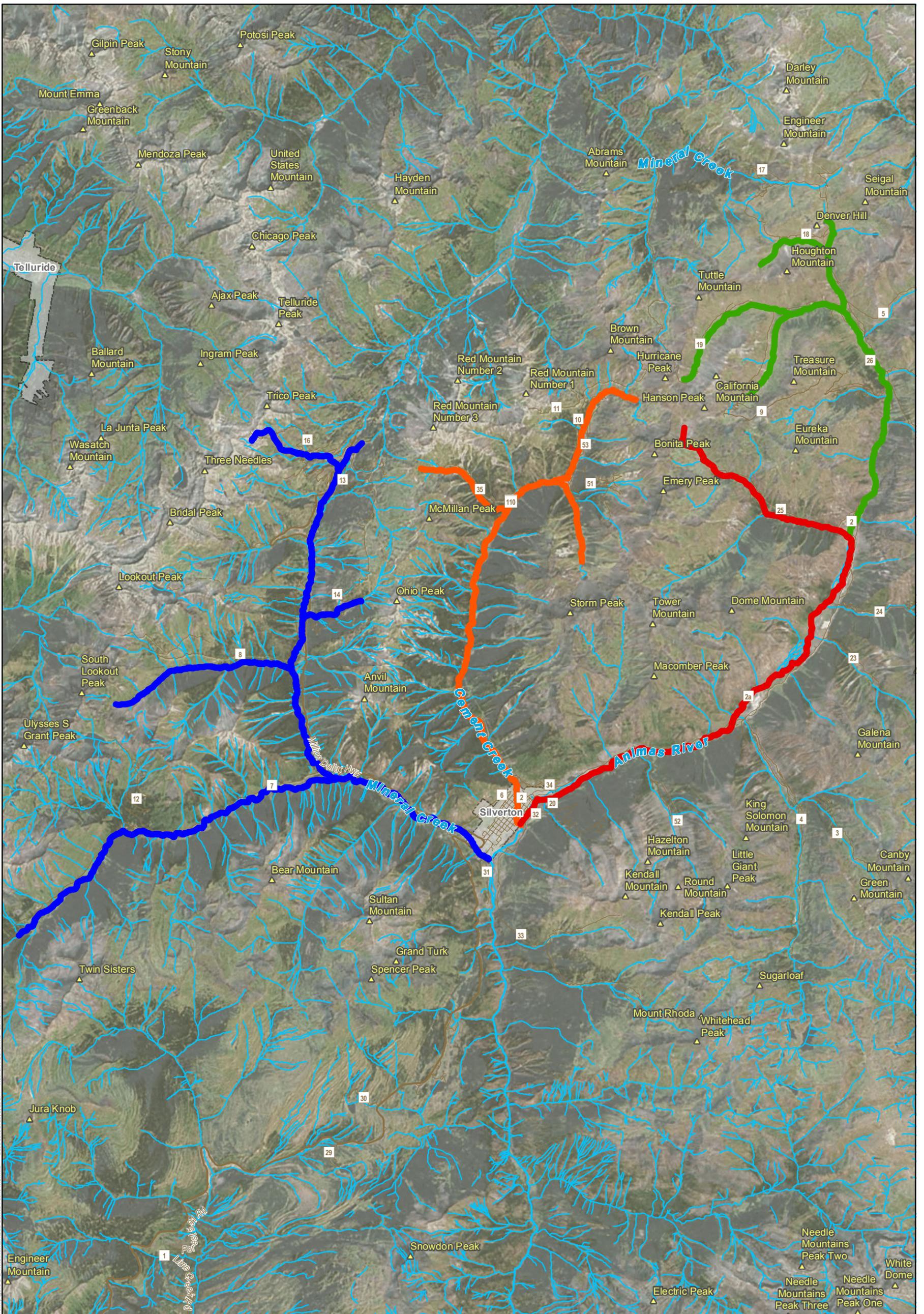
Legend:

| | |
|---|--|
| ● | Pathway complete and may be significant, quantitatively evaluated. |
| X | Pathway complete, judged to be minor compared to other exposure pathways, evaluated in the uncertainty evaluation. |
| | Pathway not complete. |

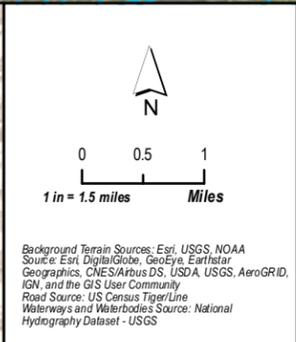
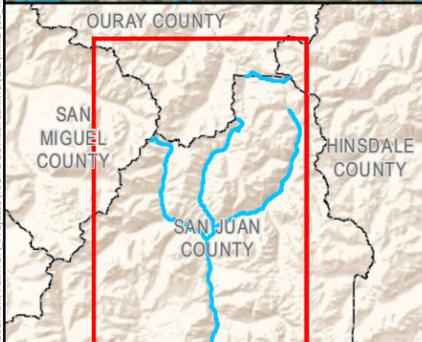
Notes:

- 1) Human disturbance may be significant, wind disturbance is judged to be minor.
- 2) Ingestion of wild game (deer and grouse).
- 3) Groundwater is used as a drinking water source for the USFS campground, surface water is evaluated for incidental ingestion.
- 4) Surface water is used as a drinking water source for dispersed camping and is evaluated for incidental ingestion.
- 5) Incidental ingestion of surface water while fishing, surface water is not anticipated to be used as a drinking water source.
- 6) Pathway will be evaluated semi-quantitatively relative to other receptors in the risk assessment.
- 7) Pathway will not be evaluated using the Adult Lead Model because the minimum exposure frequency and duration is not met for intermittent exposure.

ATV - all terrain vehicle
 USFS - United States Forest Service



Document Path: E:\Projects\79171-Bonita Peak\GIS\MXD\06 - Hiker Hunter Road - Bonita Peaks - MID.mxd Date saved: 12/15/2017 Author: FOSTER.ML CDM5.mth



Legend

Exposure Units for Hiker, Hunter, and County Road Worker

- EU1
- EU2
- EU3
- EU4

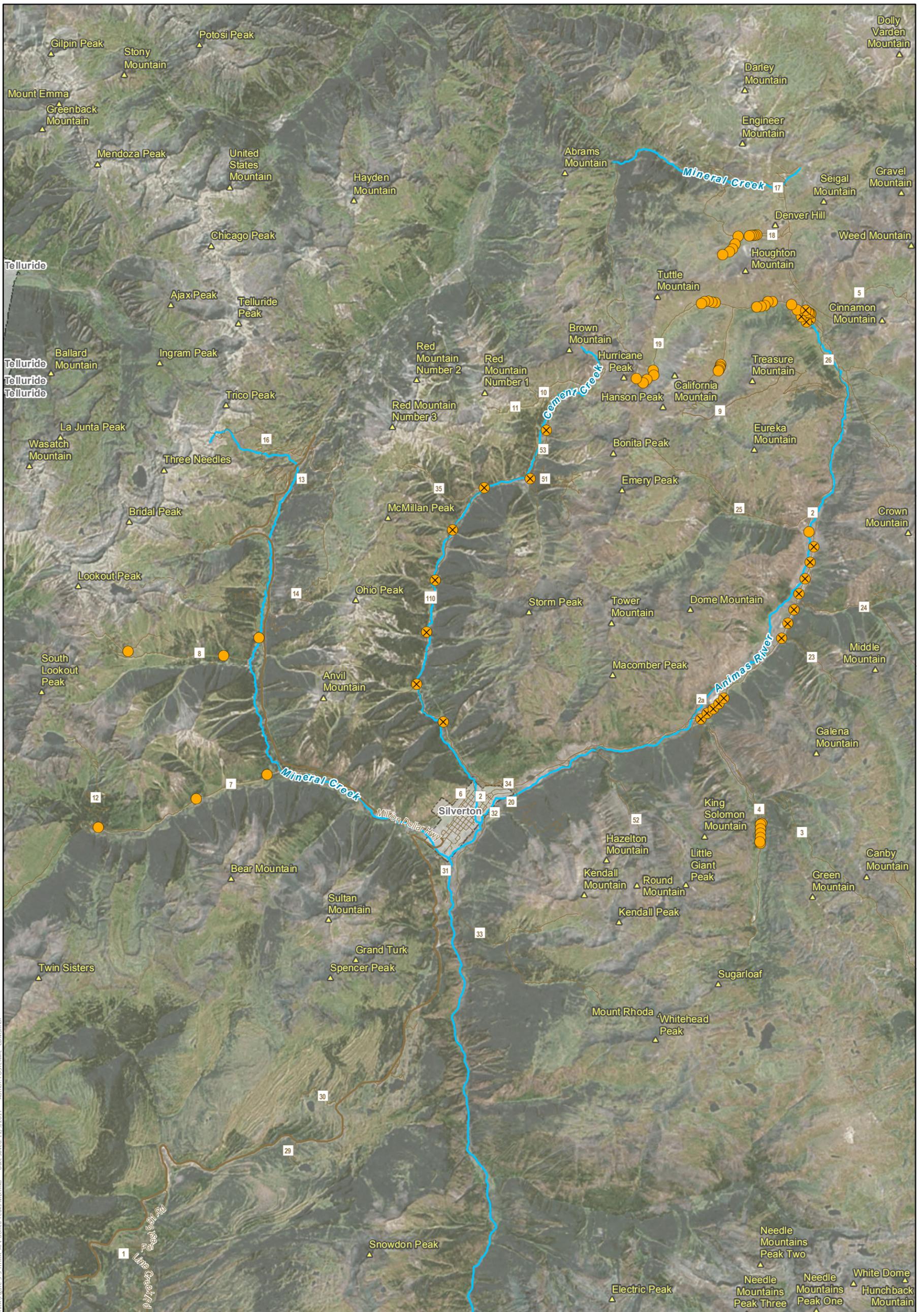
▲ Mountain Peak
 □ County Road

--- Forest Service Road
 — Road
 — Highway
 ~~~ Streams

**Figure 3-2**  
 Exposure Units for the Hiker, Hunter, and County Road Worker

Bonita Peak Mining District Superfund Site | San Juan County, CO  
 Human Health Risk Assessment

**CDM Smith**

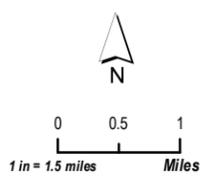


**Figure 3-3**  
**Exposure Units for the ATV Guide**  
**and ATV Rec Rider**

Bonita Peak Mining District Superfund Site | San Juan County, CO  
 Human Health Risk Assessment

**Legend**

- ⊗ Exposure Unit 5a - ATV Guide (Alpine Loop)
- Exposure Unit 5b - ATV Rec Rider
- ▲ Mountain Peak
- County Road
- Forest Service Road
- Road
- Highway
- ~ Streams



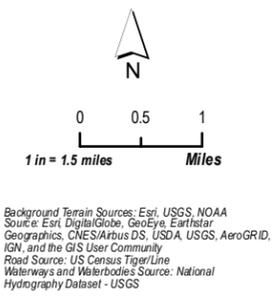
Background Terrain Sources: Esri, USGS, NOAA  
 Source: Esri, DigitalGlobe, GeoEye, Earthstar  
 Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID,  
 IGN, and the GIS User Community  
 Road Source: US Census TigerLine  
 Waterways and Waterbodies Source: National  
 Hydrography Dataset - USGS

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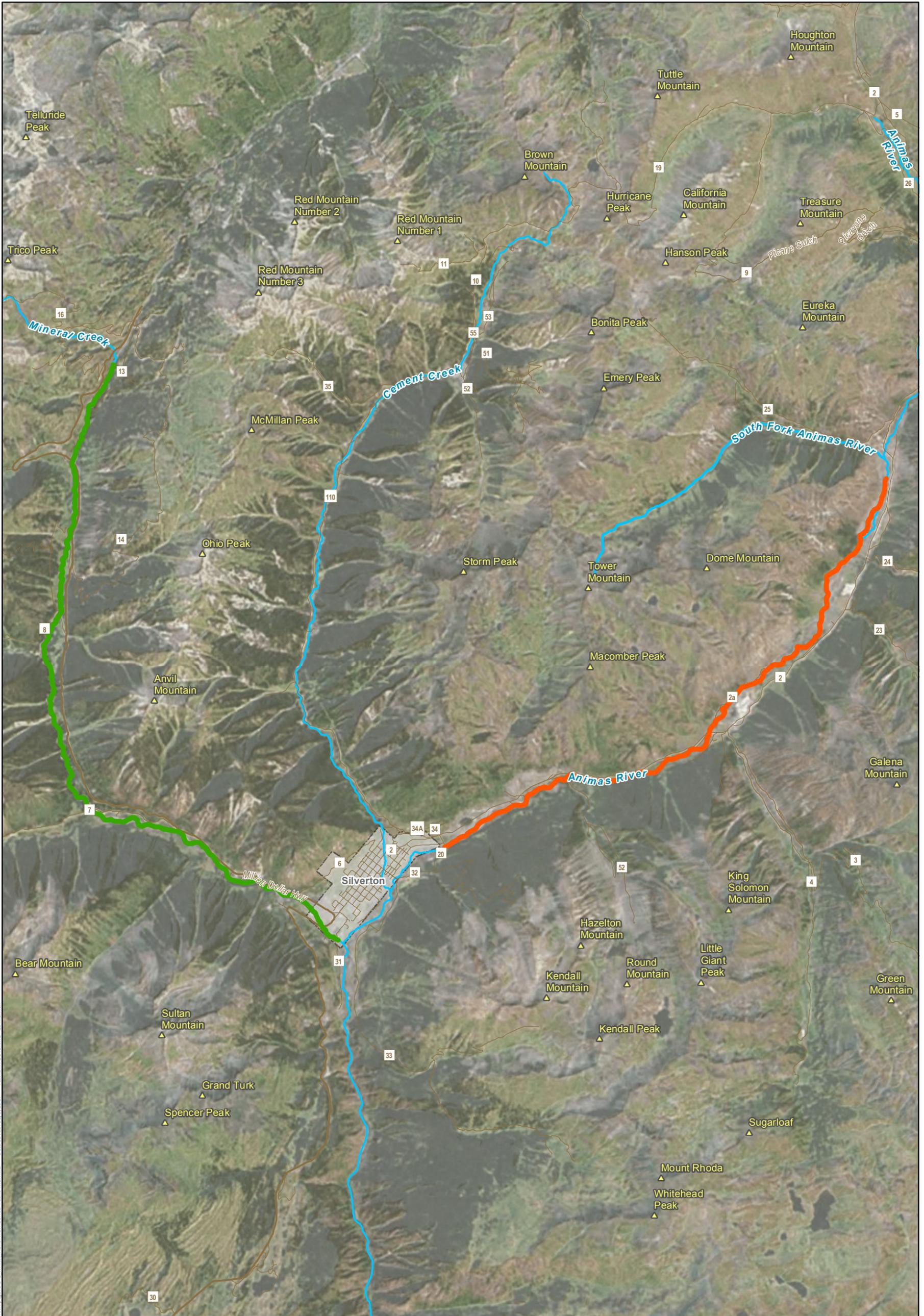
**Figure 3-4**  
**Exposure Units for Campers**  
 Bonita Peak Mining District Superfund Site | San Juan County, CO  
 Human Health Risk Assessment

- Legend**
- Exposure Unit 6 - U.S. Forest Service Campground
  - Exposure Unit 7 - Dispersed Backcountry Campsite Locations
  - ▲ Mountain Peak
  - County Road
  - Forest Service Road
  - Road
  - Highway
  - ~ Streams

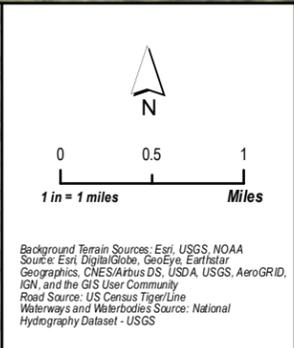


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Document Path: E:\Projects\79171\_BonitaPeak\GIS\MXD\06\_HHRA\Figure-3-5\_HHRA\_Fisherman-Bonita-Peaks-MD.mxd Date Saved: 12/5/2017 Author: FOSTER, RML CDM Smith



**Legend**

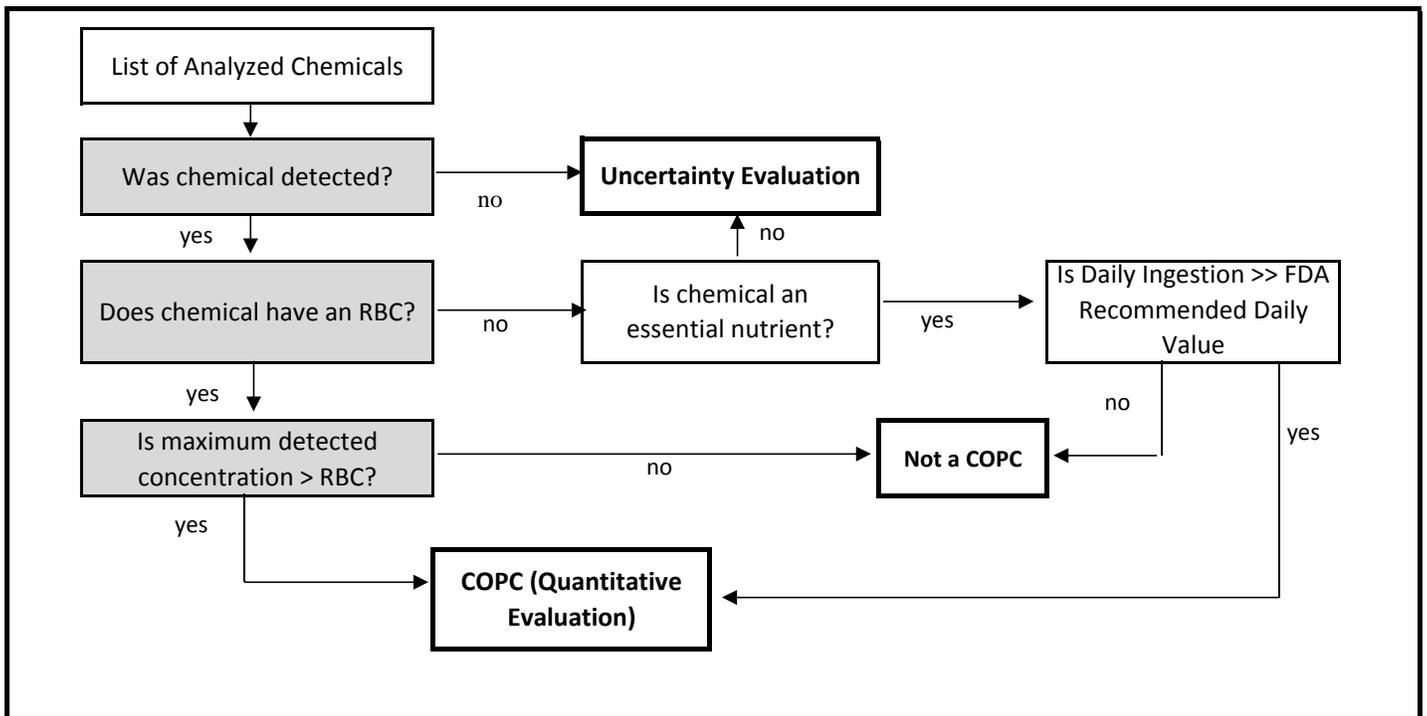
**Exposure Units for Fisherman**

- █ Exposure Unit 8 - Mineral Creek
- █ Exposure Unit 9 - Animas River
- ▲ Mountain Peak
- County Road

- Forest Service Road
- Road
- Highway
- ~ Streams

**Figure 3-5**  
 Exposure Units for the Recreational Fisherman  
 Bonita Peak Mining District Superfund Site | San Juan County, CO  
 Human Health Risk Assessment

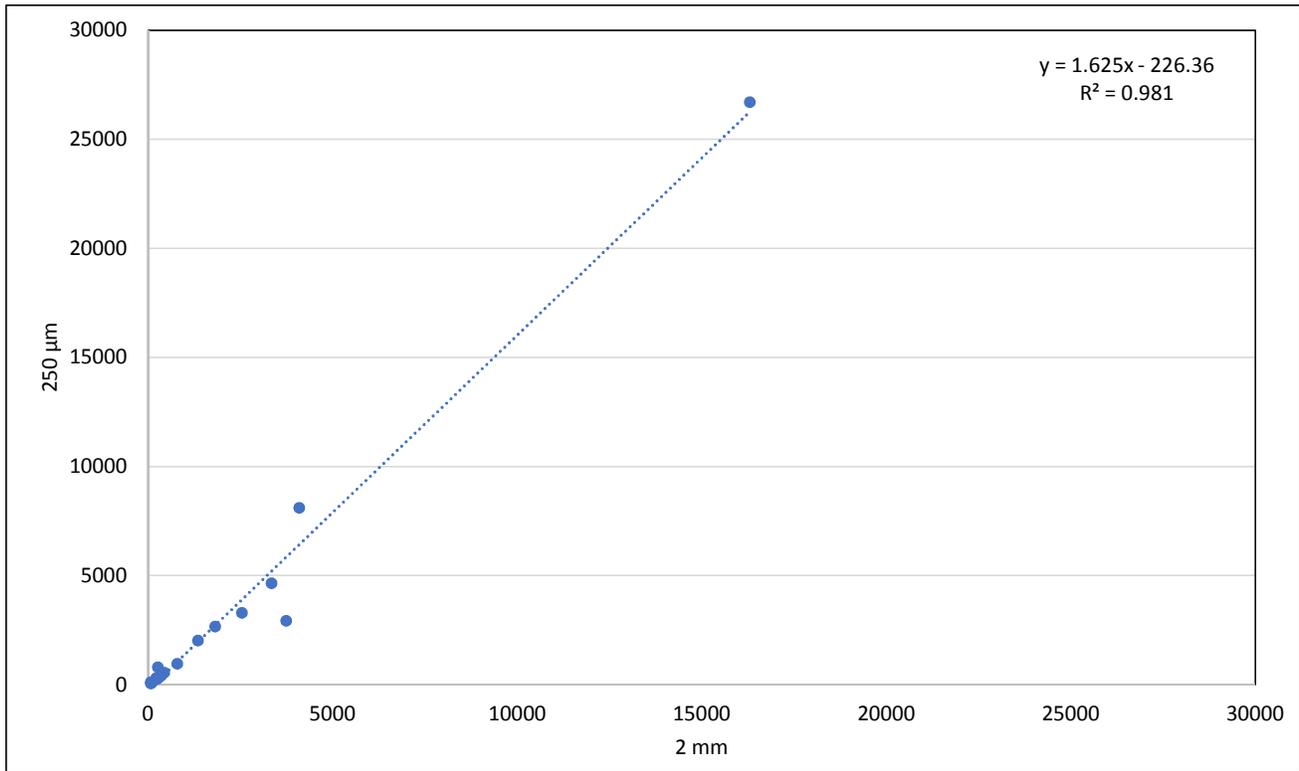
**FIGURE 3-6**  
**COPC SELECTION PROCEDURE**  
*Bonita Peak Mining District*



**Notes:**

COPC = chemical of potential concern  
 FDA = Food and Drug Administration  
 RBC = Risk-based concentration

**FIGURE 5-1**  
**REGRESSION ANALYSIS OF LEAD SOIL SAMPLES SIEVED TO 2-mm AND 250- $\mu$ m**  
*Bonita Peak Mining District*



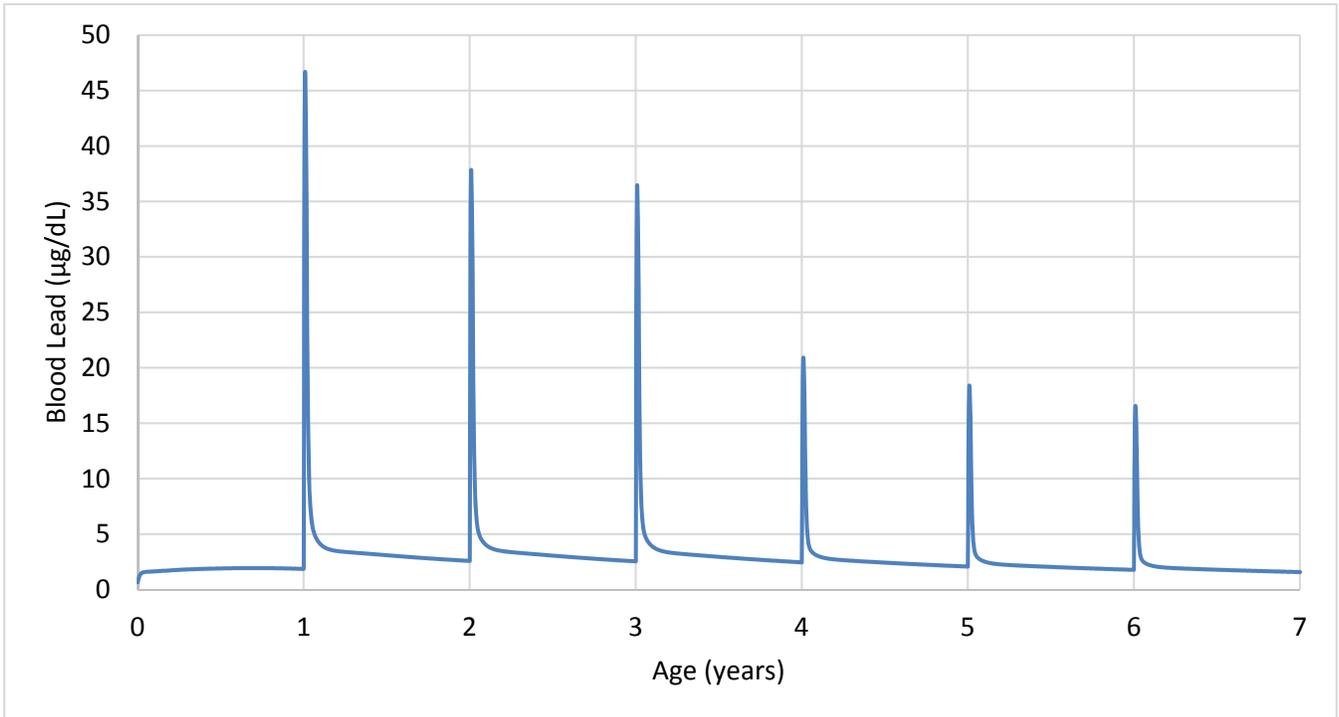
**Notes:**

$\mu$ m = micrometer  
mm = millimeter

**FIGURE 5-2**

**ALL AGES LEAD MODEL - PREDICTED BLOOD LEAD LEVELS FOR A CHILD (DISPERSED CAMPSITE)**

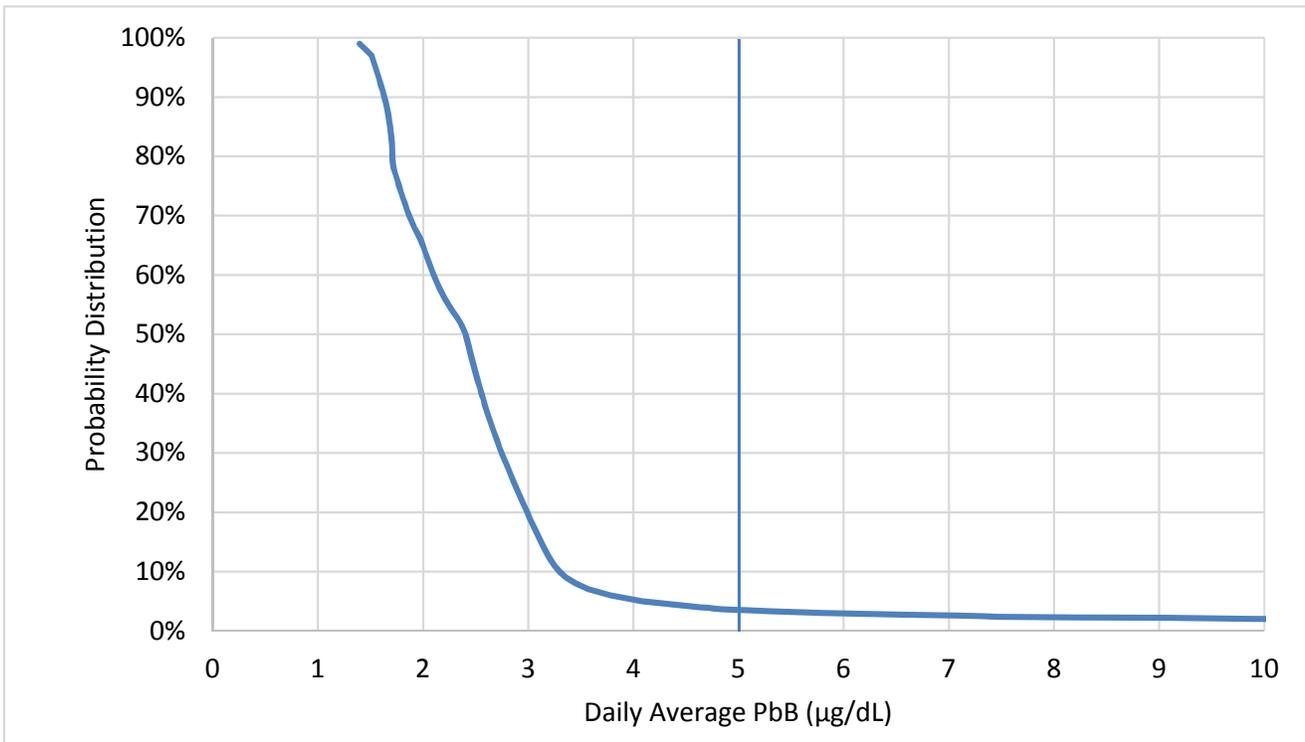
*Bonita Peak Mining District*



µg/dL = micrograms per deciliter

**FIGURE 5-3**  
**ALL AGES LEAD MODEL - PROBABILITY DISTRIBUTION OF BLOOD LEAD LEVELS FOR A CHILD**  
**(DISPERSED CAMPSITE)**

*Bonita Peak Mining District*



µg/dL = micrograms per deciliter  
% = percent

**Notes:**

Cutoff = 5 µg/dL

% Above = 3.5%

Age Range = 12-72 months

# Appendix A

## Bonita Peak Mining District Scribe Database

(see Microsoft Access file attached within PDF)

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# Appendix B

## ProUCL Output Files

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| A  | B                                                                                                                                 | C | D                                | E | F                                           | G | H       | I     | J | K | L |
|----|-----------------------------------------------------------------------------------------------------------------------------------|---|----------------------------------|---|---------------------------------------------|---|---------|-------|---|---|---|
| 1  | <b>UCL Statistics for Data Sets with Non-Detects</b>                                                                              |   |                                  |   |                                             |   |         |       |   |   |   |
| 2  |                                                                                                                                   |   |                                  |   |                                             |   |         |       |   |   |   |
| 3  | User Selected Options                                                                                                             |   |                                  |   |                                             |   |         |       |   |   |   |
| 4  | Date/Time of Computation                                                                                                          |   | ProUCL 5.111/20/2017 12:29:03 PM |   |                                             |   |         |       |   |   |   |
| 5  | From File                                                                                                                         |   | BPMD_HHRA_AirInput.xls           |   |                                             |   |         |       |   |   |   |
| 6  | Full Precision                                                                                                                    |   | OFF                              |   |                                             |   |         |       |   |   |   |
| 7  | Confidence Coefficient                                                                                                            |   | 95%                              |   |                                             |   |         |       |   |   |   |
| 8  | Number of Bootstrap Operations                                                                                                    |   | 2000                             |   |                                             |   |         |       |   |   |   |
| 9  |                                                                                                                                   |   |                                  |   |                                             |   |         |       |   |   |   |
| 10 | <b>Result (eu2_arsenic)</b>                                                                                                       |   |                                  |   |                                             |   |         |       |   |   |   |
| 11 |                                                                                                                                   |   |                                  |   |                                             |   |         |       |   |   |   |
| 12 | <b>General Statistics</b>                                                                                                         |   |                                  |   |                                             |   |         |       |   |   |   |
| 13 | Total Number of Observations                                                                                                      |   | 3                                |   | Number of Distinct Observations             |   | 2       |       |   |   |   |
| 14 | Number of Detects                                                                                                                 |   | 0                                |   | Number of Non-Detects                       |   | 3       |       |   |   |   |
| 15 | Number of Distinct Detects                                                                                                        |   | 0                                |   | Number of Distinct Non-Detects              |   | 2       |       |   |   |   |
| 16 |                                                                                                                                   |   |                                  |   |                                             |   |         |       |   |   |   |
| 17 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                |   |                                  |   |                                             |   |         |       |   |   |   |
| 18 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>          |   |                                  |   |                                             |   |         |       |   |   |   |
| 19 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b> |   |                                  |   |                                             |   |         |       |   |   |   |
| 20 |                                                                                                                                   |   |                                  |   |                                             |   |         |       |   |   |   |
| 21 | <b>The data set for variable Result (eu2_arsenic) was not processed!</b>                                                          |   |                                  |   |                                             |   |         |       |   |   |   |
| 22 |                                                                                                                                   |   |                                  |   |                                             |   |         |       |   |   |   |
| 23 |                                                                                                                                   |   |                                  |   |                                             |   |         |       |   |   |   |
| 24 |                                                                                                                                   |   |                                  |   |                                             |   |         |       |   |   |   |
| 25 | <b>Result (eu2_chromium)</b>                                                                                                      |   |                                  |   |                                             |   |         |       |   |   |   |
| 26 |                                                                                                                                   |   |                                  |   |                                             |   |         |       |   |   |   |
| 27 | <b>General Statistics</b>                                                                                                         |   |                                  |   |                                             |   |         |       |   |   |   |
| 28 | Total Number of Observations                                                                                                      |   | 3                                |   | Number of Distinct Observations             |   | 3       |       |   |   |   |
| 29 |                                                                                                                                   |   |                                  |   | Number of Missing Observations              |   | 0       |       |   |   |   |
| 30 | Minimum                                                                                                                           |   | 0.19                             |   | Mean                                        |   | 0.203   |       |   |   |   |
| 31 | Maximum                                                                                                                           |   | 0.22                             |   | Median                                      |   | 0.2     |       |   |   |   |
| 32 | SD                                                                                                                                |   | 0.0153                           |   | Std. Error of Mean                          |   | 0.00882 |       |   |   |   |
| 33 | Coefficient of Variation                                                                                                          |   | 0.0751                           |   | Skewness                                    |   | 0.935   |       |   |   |   |
| 34 |                                                                                                                                   |   |                                  |   |                                             |   |         |       |   |   |   |
| 35 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                        |   |                                  |   |                                             |   |         |       |   |   |   |
| 36 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                            |   |                                  |   |                                             |   |         |       |   |   |   |
| 37 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                               |   |                                  |   |                                             |   |         |       |   |   |   |
| 38 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                    |   |                                  |   |                                             |   |         |       |   |   |   |
| 39 |                                                                                                                                   |   |                                  |   |                                             |   |         |       |   |   |   |
| 40 | <b>Normal GOF Test</b>                                                                                                            |   |                                  |   |                                             |   |         |       |   |   |   |
| 41 | Shapiro Wilk Test Statistic                                                                                                       |   | 0.964                            |   | <b>Shapiro Wilk GOF Test</b>                |   |         |       |   |   |   |
| 42 | 5% Shapiro Wilk Critical Value                                                                                                    |   | 0.767                            |   | Data appear Normal at 5% Significance Level |   |         |       |   |   |   |
| 43 | Lilliefors Test Statistic                                                                                                         |   | 0.253                            |   | <b>Lilliefors GOF Test</b>                  |   |         |       |   |   |   |
| 44 | 5% Lilliefors Critical Value                                                                                                      |   | 0.425                            |   | Data appear Normal at 5% Significance Level |   |         |       |   |   |   |
| 45 | <b>Data appear Normal at 5% Significance Level</b>                                                                                |   |                                  |   |                                             |   |         |       |   |   |   |
| 46 |                                                                                                                                   |   |                                  |   |                                             |   |         |       |   |   |   |
| 47 | <b>Assuming Normal Distribution</b>                                                                                               |   |                                  |   |                                             |   |         |       |   |   |   |
| 48 | <b>95% Normal UCL</b>                                                                                                             |   |                                  |   | <b>95% UCLs (Adjusted for Skewness)</b>     |   |         |       |   |   |   |
| 49 | 95% Student's-t UCL                                                                                                               |   | 0.229                            |   | 95% Adjusted-CLT UCL (Chen-1995)            |   |         | 0.223 |   |   |   |
| 50 |                                                                                                                                   |   |                                  |   | 95% Modified-t UCL (Johnson-1978)           |   |         | 0.23  |   |   |   |
| 51 |                                                                                                                                   |   |                                  |   |                                             |   |         |       |   |   |   |
| 52 | <b>Gamma GOF Test</b>                                                                                                             |   |                                  |   |                                             |   |         |       |   |   |   |
| 53 | <b>Not Enough Data to Perform GOF Test</b>                                                                                        |   |                                  |   |                                             |   |         |       |   |   |   |
| 54 |                                                                                                                                   |   |                                  |   |                                             |   |         |       |   |   |   |
| 55 | <b>Gamma Statistics</b>                                                                                                           |   |                                  |   |                                             |   |         |       |   |   |   |
| 56 | k hat (MLE)                                                                                                                       |   | 269.4                            |   | k star (bias corrected MLE)                 |   | N/A     |       |   |   |   |
| 57 | Theta hat (MLE)                                                                                                                   |   | 7.5472E-4                        |   | Theta star (bias corrected MLE)             |   | N/A     |       |   |   |   |
| 58 | nu hat (MLE)                                                                                                                      |   | 1617                             |   | nu star (bias corrected)                    |   | N/A     |       |   |   |   |
| 59 | MLE Mean (bias corrected)                                                                                                         |   | N/A                              |   | MLE Sd (bias corrected)                     |   | N/A     |       |   |   |   |
| 60 |                                                                                                                                   |   |                                  |   | Approximate Chi Square Value (0.05)         |   | N/A     |       |   |   |   |
| 61 | Adjusted Level of Significance                                                                                                    |   | N/A                              |   | Adjusted Chi Square Value                   |   | N/A     |       |   |   |   |
| 62 |                                                                                                                                   |   |                                  |   |                                             |   |         |       |   |   |   |
| 63 | <b>Assuming Gamma Distribution</b>                                                                                                |   |                                  |   |                                             |   |         |       |   |   |   |
| 64 | 95% Approximate Gamma UCL (use when n>=50))                                                                                       |   | N/A                              |   | 95% Adjusted Gamma UCL (use when n<50)      |   |         | N/A   |   |   |   |
| 65 |                                                                                                                                   |   |                                  |   |                                             |   |         |       |   |   |   |
| 66 | <b>Lognormal GOF Test</b>                                                                                                         |   |                                  |   |                                             |   |         |       |   |   |   |
| 67 | Shapiro Wilk Test Statistic                                                                                                       |   | 0.971                            |   | <b>Shapiro Wilk Lognormal GOF Test</b>      |   |         |       |   |   |   |

| A   | B                                                                                                                                        | C | D | E       | F                                              | G | H | I       | J | K | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---|---------|------------------------------------------------|---|---|---------|---|---|---|
| 68  | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.767   | Data appear Lognormal at 5% Significance Level |   |   |         |   |   |   |
| 69  | Lilliefors Test Statistic                                                                                                                |   |   | 0.245   | <b>Lilliefors Lognormal GOF Test</b>           |   |   |         |   |   |   |
| 70  | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.425   | Data appear Lognormal at 5% Significance Level |   |   |         |   |   |   |
| 71  | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |         |                                                |   |   |         |   |   |   |
| 72  |                                                                                                                                          |   |   |         |                                                |   |   |         |   |   |   |
| 73  | <b>Lognormal Statistics</b>                                                                                                              |   |   |         |                                                |   |   |         |   |   |   |
| 74  | Minimum of Logged Data                                                                                                                   |   |   | -1.661  | Mean of logged Data                            |   |   | -1.595  |   |   |   |
| 75  | Maximum of Logged Data                                                                                                                   |   |   | -1.514  | SD of logged Data                              |   |   | 0.0744  |   |   |   |
| 76  |                                                                                                                                          |   |   |         |                                                |   |   |         |   |   |   |
| 77  | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |         |                                                |   |   |         |   |   |   |
| 78  | 95% H-UCL                                                                                                                                |   |   | N/A     | 90% Chebyshev (MVUE) UCL                       |   |   | 0.23    |   |   |   |
| 79  | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 0.241   | 97.5% Chebyshev (MVUE) UCL                     |   |   | 0.258   |   |   |   |
| 80  | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 0.29    |                                                |   |   |         |   |   |   |
| 81  |                                                                                                                                          |   |   |         |                                                |   |   |         |   |   |   |
| 82  | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |         |                                                |   |   |         |   |   |   |
| 83  | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |         |                                                |   |   |         |   |   |   |
| 84  |                                                                                                                                          |   |   |         |                                                |   |   |         |   |   |   |
| 85  | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |         |                                                |   |   |         |   |   |   |
| 86  | 95% CLT UCL                                                                                                                              |   |   | 0.218   | 95% Jackknife UCL                              |   |   | 0.229   |   |   |   |
| 87  | 95% Standard Bootstrap UCL                                                                                                               |   |   | N/A     | 95% Bootstrap-t UCL                            |   |   | N/A     |   |   |   |
| 88  | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | N/A     | 95% Percentile Bootstrap UCL                   |   |   | N/A     |   |   |   |
| 89  | 95% BCA Bootstrap UCL                                                                                                                    |   |   | N/A     |                                                |   |   |         |   |   |   |
| 90  | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 0.23    | 95% Chebyshev(Mean, Sd) UCL                    |   |   | 0.242   |   |   |   |
| 91  | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 0.258   | 99% Chebyshev(Mean, Sd) UCL                    |   |   | 0.291   |   |   |   |
| 92  |                                                                                                                                          |   |   |         |                                                |   |   |         |   |   |   |
| 93  | <b>Suggested UCL to Use</b>                                                                                                              |   |   |         |                                                |   |   |         |   |   |   |
| 94  | 95% Student's-t UCL                                                                                                                      |   |   | 0.229   |                                                |   |   |         |   |   |   |
| 95  |                                                                                                                                          |   |   |         |                                                |   |   |         |   |   |   |
| 96  | <b>Recommended UCL exceeds the maximum observation</b>                                                                                   |   |   |         |                                                |   |   |         |   |   |   |
| 97  |                                                                                                                                          |   |   |         |                                                |   |   |         |   |   |   |
| 98  | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |         |                                                |   |   |         |   |   |   |
| 99  | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |         |                                                |   |   |         |   |   |   |
| 100 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |         |                                                |   |   |         |   |   |   |
| 101 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |         |                                                |   |   |         |   |   |   |
| 102 |                                                                                                                                          |   |   |         |                                                |   |   |         |   |   |   |
| 103 |                                                                                                                                          |   |   |         |                                                |   |   |         |   |   |   |
| 104 | <b>Result (eu2_lead)</b>                                                                                                                 |   |   |         |                                                |   |   |         |   |   |   |
| 105 |                                                                                                                                          |   |   |         |                                                |   |   |         |   |   |   |
| 106 | <b>General Statistics</b>                                                                                                                |   |   |         |                                                |   |   |         |   |   |   |
| 107 | Total Number of Observations                                                                                                             |   |   | 3       | Number of Distinct Observations                |   |   | 3       |   |   |   |
| 108 |                                                                                                                                          |   |   |         | Number of Missing Observations                 |   |   | 0       |   |   |   |
| 109 | Minimum                                                                                                                                  |   |   | 0.015   | Mean                                           |   |   | 0.0207  |   |   |   |
| 110 | Maximum                                                                                                                                  |   |   | 0.024   | Median                                         |   |   | 0.023   |   |   |   |
| 111 | SD                                                                                                                                       |   |   | 0.00493 | Std. Error of Mean                             |   |   | 0.00285 |   |   |   |
| 112 | Coefficient of Variation                                                                                                                 |   |   | 0.239   | Skewness                                       |   |   | -1.652  |   |   |   |
| 113 |                                                                                                                                          |   |   |         |                                                |   |   |         |   |   |   |
| 114 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |   |   |         |                                                |   |   |         |   |   |   |
| 115 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |   |   |         |                                                |   |   |         |   |   |   |
| 116 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |   |   |         |                                                |   |   |         |   |   |   |
| 117 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |   |   |         |                                                |   |   |         |   |   |   |
| 118 |                                                                                                                                          |   |   |         |                                                |   |   |         |   |   |   |
| 119 | <b>Normal GOF Test</b>                                                                                                                   |   |   |         |                                                |   |   |         |   |   |   |
| 120 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.832   | <b>Shapiro Wilk GOF Test</b>                   |   |   |         |   |   |   |
| 121 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.767   | Data appear Normal at 5% Significance Level    |   |   |         |   |   |   |
| 122 | Lilliefors Test Statistic                                                                                                                |   |   | 0.349   | <b>Lilliefors GOF Test</b>                     |   |   |         |   |   |   |
| 123 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.425   | Data appear Normal at 5% Significance Level    |   |   |         |   |   |   |
| 124 | <b>Data appear Normal at 5% Significance Level</b>                                                                                       |   |   |         |                                                |   |   |         |   |   |   |
| 125 |                                                                                                                                          |   |   |         |                                                |   |   |         |   |   |   |
| 126 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |         |                                                |   |   |         |   |   |   |
| 127 | <b>95% Normal UCL</b>                                                                                                                    |   |   |         | <b>95% UCLs (Adjusted for Skewness)</b>        |   |   |         |   |   |   |
| 128 | 95% Student's-t UCL                                                                                                                      |   |   | 0.029   | 95% Adjusted-CLT UCL (Chen-1995)               |   |   | 0.0224  |   |   |   |
| 129 |                                                                                                                                          |   |   |         | 95% Modified-t UCL (Johnson-1978)              |   |   | 0.0285  |   |   |   |
| 130 |                                                                                                                                          |   |   |         |                                                |   |   |         |   |   |   |
| 131 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |         |                                                |   |   |         |   |   |   |
| 132 | <b>Not Enough Data to Perform GOF Test</b>                                                                                               |   |   |         |                                                |   |   |         |   |   |   |
| 133 |                                                                                                                                          |   |   |         |                                                |   |   |         |   |   |   |
| 134 | <b>Gamma Statistics</b>                                                                                                                  |   |   |         |                                                |   |   |         |   |   |   |

| A   | B | C | D | E | F                                                                                                                                        | G         | H | I | J | K                                              | L      |
|-----|---|---|---|---|------------------------------------------------------------------------------------------------------------------------------------------|-----------|---|---|---|------------------------------------------------|--------|
| 135 |   |   |   |   | k hat (MLE)                                                                                                                              | 23.61     |   |   |   | k star (bias corrected MLE)                    | N/A    |
| 136 |   |   |   |   | Theta hat (MLE)                                                                                                                          | 8.7516E-4 |   |   |   | Theta star (bias corrected MLE)                | N/A    |
| 137 |   |   |   |   | nu hat (MLE)                                                                                                                             | 141.7     |   |   |   | nu star (bias corrected)                       | N/A    |
| 138 |   |   |   |   | MLE Mean (bias corrected)                                                                                                                | N/A       |   |   |   | MLE Sd (bias corrected)                        | N/A    |
| 139 |   |   |   |   |                                                                                                                                          |           |   |   |   | Approximate Chi Square Value (0.05)            | N/A    |
| 140 |   |   |   |   | Adjusted Level of Significance                                                                                                           | N/A       |   |   |   | Adjusted Chi Square Value                      | N/A    |
| 141 |   |   |   |   |                                                                                                                                          |           |   |   |   |                                                |        |
| 142 |   |   |   |   | <b>Assuming Gamma Distribution</b>                                                                                                       |           |   |   |   |                                                |        |
| 143 |   |   |   |   | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | N/A       |   |   |   | 95% Adjusted Gamma UCL (use when n<50)         | N/A    |
| 144 |   |   |   |   |                                                                                                                                          |           |   |   |   |                                                |        |
| 145 |   |   |   |   | <b>Lognormal GOF Test</b>                                                                                                                |           |   |   |   |                                                |        |
| 146 |   |   |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.817     |   |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>         |        |
| 147 |   |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                           | 0.767     |   |   |   | Data appear Lognormal at 5% Significance Level |        |
| 148 |   |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.356     |   |   |   | <b>Lilliefors Lognormal GOF Test</b>           |        |
| 149 |   |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.425     |   |   |   | Data appear Lognormal at 5% Significance Level |        |
| 150 |   |   |   |   | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |           |   |   |   |                                                |        |
| 151 |   |   |   |   |                                                                                                                                          |           |   |   |   |                                                |        |
| 152 |   |   |   |   | <b>Lognormal Statistics</b>                                                                                                              |           |   |   |   |                                                |        |
| 153 |   |   |   |   | Minimum of Logged Data                                                                                                                   | -4.2      |   |   |   | Mean of logged Data                            | -3.901 |
| 154 |   |   |   |   | Maximum of Logged Data                                                                                                                   | -3.73     |   |   |   | SD of logged Data                              | 0.26   |
| 155 |   |   |   |   |                                                                                                                                          |           |   |   |   |                                                |        |
| 156 |   |   |   |   | <b>Assuming Lognormal Distribution</b>                                                                                                   |           |   |   |   |                                                |        |
| 157 |   |   |   |   | 95% H-UCL                                                                                                                                | 0.0417    |   |   |   | 90% Chebyshev (MVUE) UCL                       | 0.0299 |
| 158 |   |   |   |   | 95% Chebyshev (MVUE) UCL                                                                                                                 | 0.0341    |   |   |   | 97.5% Chebyshev (MVUE) UCL                     | 0.0399 |
| 159 |   |   |   |   | 99% Chebyshev (MVUE) UCL                                                                                                                 | 0.0513    |   |   |   |                                                |        |
| 160 |   |   |   |   |                                                                                                                                          |           |   |   |   |                                                |        |
| 161 |   |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |           |   |   |   |                                                |        |
| 162 |   |   |   |   | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |           |   |   |   |                                                |        |
| 163 |   |   |   |   |                                                                                                                                          |           |   |   |   |                                                |        |
| 164 |   |   |   |   | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |           |   |   |   |                                                |        |
| 165 |   |   |   |   | 95% CLT UCL                                                                                                                              | 0.0254    |   |   |   | 95% Jackknife UCL                              | 0.029  |
| 166 |   |   |   |   | 95% Standard Bootstrap UCL                                                                                                               | N/A       |   |   |   | 95% Bootstrap-t UCL                            | N/A    |
| 167 |   |   |   |   | 95% Hall's Bootstrap UCL                                                                                                                 | N/A       |   |   |   | 95% Percentile Bootstrap UCL                   | N/A    |
| 168 |   |   |   |   | 95% BCA Bootstrap UCL                                                                                                                    | N/A       |   |   |   |                                                |        |
| 169 |   |   |   |   | 90% Chebyshev(Mean, Sd) UCL                                                                                                              | 0.0292    |   |   |   | 95% Chebyshev(Mean, Sd) UCL                    | 0.0331 |
| 170 |   |   |   |   | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            | 0.0385    |   |   |   | 99% Chebyshev(Mean, Sd) UCL                    | 0.049  |
| 171 |   |   |   |   |                                                                                                                                          |           |   |   |   |                                                |        |
| 172 |   |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |           |   |   |   |                                                |        |
| 173 |   |   |   |   | 95% Student's-t UCL                                                                                                                      | 0.029     |   |   |   |                                                |        |
| 174 |   |   |   |   |                                                                                                                                          |           |   |   |   |                                                |        |
| 175 |   |   |   |   | <b>Recommended UCL exceeds the maximum observation</b>                                                                                   |           |   |   |   |                                                |        |
| 176 |   |   |   |   |                                                                                                                                          |           |   |   |   |                                                |        |
| 177 |   |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |           |   |   |   |                                                |        |
| 178 |   |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |           |   |   |   |                                                |        |
| 179 |   |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |           |   |   |   |                                                |        |
| 180 |   |   |   |   | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |           |   |   |   |                                                |        |
| 181 |   |   |   |   |                                                                                                                                          |           |   |   |   |                                                |        |
| 182 |   |   |   |   | <b>Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be</b>                 |           |   |   |   |                                                |        |
| 183 |   |   |   |   | <b>reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.</b>                                       |           |   |   |   |                                                |        |
| 184 |   |   |   |   |                                                                                                                                          |           |   |   |   |                                                |        |
| 185 |   |   |   |   |                                                                                                                                          |           |   |   |   |                                                |        |
| 186 |   |   |   |   | <b>Result (eu2_manganese)</b>                                                                                                            |           |   |   |   |                                                |        |
| 187 |   |   |   |   |                                                                                                                                          |           |   |   |   |                                                |        |
| 188 |   |   |   |   | <b>General Statistics</b>                                                                                                                |           |   |   |   |                                                |        |
| 189 |   |   |   |   | Total Number of Observations                                                                                                             | 3         |   |   |   | Number of Distinct Observations                | 3      |
| 190 |   |   |   |   |                                                                                                                                          |           |   |   |   | Number of Missing Observations                 | 0      |
| 191 |   |   |   |   | Minimum                                                                                                                                  | 0.069     |   |   |   | Mean                                           | 0.116  |
| 192 |   |   |   |   | Maximum                                                                                                                                  | 0.15      |   |   |   | Median                                         | 0.13   |
| 193 |   |   |   |   | SD                                                                                                                                       | 0.0422    |   |   |   | Std. Error of Mean                             | 0.0244 |
| 194 |   |   |   |   | Coefficient of Variation                                                                                                                 | 0.363     |   |   |   | Skewness                                       | -1.305 |
| 195 |   |   |   |   |                                                                                                                                          |           |   |   |   |                                                |        |
| 196 |   |   |   |   | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |           |   |   |   |                                                |        |
| 197 |   |   |   |   | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |           |   |   |   |                                                |        |
| 198 |   |   |   |   | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |           |   |   |   |                                                |        |
| 199 |   |   |   |   | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |           |   |   |   |                                                |        |
| 200 |   |   |   |   |                                                                                                                                          |           |   |   |   |                                                |        |
| 201 |   |   |   |   | <b>Normal GOF Test</b>                                                                                                                   |           |   |   |   |                                                |        |

| A   | B                                                                                                                                        | C | E | F      | G                                              | H | I | J | K      | L     |  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|------------------------------------------------|---|---|---|--------|-------|--|
| 202 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.921  | Shapiro Wilk GOF Test                          |   |   |   |        |       |  |
| 203 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.767  | Data appear Normal at 5% Significance Level    |   |   |   |        |       |  |
| 204 | Lilliefors Test Statistic                                                                                                                |   |   | 0.294  | Lilliefors GOF Test                            |   |   |   |        |       |  |
| 205 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.425  | Data appear Normal at 5% Significance Level    |   |   |   |        |       |  |
| 206 | Data appear Normal at 5% Significance Level                                                                                              |   |   |        |                                                |   |   |   |        |       |  |
| 207 |                                                                                                                                          |   |   |        |                                                |   |   |   |        |       |  |
| 208 | Assuming Normal Distribution                                                                                                             |   |   |        |                                                |   |   |   |        |       |  |
| 209 | 95% Normal UCL                                                                                                                           |   |   |        | 95% UCLs (Adjusted for Skewness)               |   |   |   |        |       |  |
| 210 | 95% Student's-t UCL                                                                                                                      |   |   | 0.187  | 95% Adjusted-CLT UCL (Chen-1995)               |   |   |   |        | 0.137 |  |
| 211 |                                                                                                                                          |   |   |        | 95% Modified-t UCL (Johnson-1978)              |   |   |   |        | 0.184 |  |
| 212 |                                                                                                                                          |   |   |        |                                                |   |   |   |        |       |  |
| 213 | Gamma GOF Test                                                                                                                           |   |   |        |                                                |   |   |   |        |       |  |
| 214 | Not Enough Data to Perform GOF Test                                                                                                      |   |   |        |                                                |   |   |   |        |       |  |
| 215 |                                                                                                                                          |   |   |        |                                                |   |   |   |        |       |  |
| 216 | Gamma Statistics                                                                                                                         |   |   |        |                                                |   |   |   |        |       |  |
| 217 | k hat (MLE)                                                                                                                              |   |   | 9.712  | k star (bias corrected MLE)                    |   |   |   | N/A    |       |  |
| 218 | Theta hat (MLE)                                                                                                                          |   |   | 0.012  | Theta star (bias corrected MLE)                |   |   |   | N/A    |       |  |
| 219 | nu hat (MLE)                                                                                                                             |   |   | 58.27  | nu star (bias corrected)                       |   |   |   | N/A    |       |  |
| 220 | MLE Mean (bias corrected)                                                                                                                |   |   | N/A    | MLE Sd (bias corrected)                        |   |   |   | N/A    |       |  |
| 221 |                                                                                                                                          |   |   |        | Approximate Chi Square Value (0.05)            |   |   |   | N/A    |       |  |
| 222 | Adjusted Level of Significance                                                                                                           |   |   | N/A    | Adjusted Chi Square Value                      |   |   |   | N/A    |       |  |
| 223 |                                                                                                                                          |   |   |        |                                                |   |   |   |        |       |  |
| 224 | Assuming Gamma Distribution                                                                                                              |   |   |        |                                                |   |   |   |        |       |  |
| 225 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |   | N/A    | 95% Adjusted Gamma UCL (use when n<50)         |   |   |   | N/A    |       |  |
| 226 |                                                                                                                                          |   |   |        |                                                |   |   |   |        |       |  |
| 227 | Lognormal GOF Test                                                                                                                       |   |   |        |                                                |   |   |   |        |       |  |
| 228 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.883  | Shapiro Wilk Lognormal GOF Test                |   |   |   |        |       |  |
| 229 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.767  | Data appear Lognormal at 5% Significance Level |   |   |   |        |       |  |
| 230 | Lilliefors Test Statistic                                                                                                                |   |   | 0.32   | Lilliefors Lognormal GOF Test                  |   |   |   |        |       |  |
| 231 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.425  | Data appear Lognormal at 5% Significance Level |   |   |   |        |       |  |
| 232 | Data appear Lognormal at 5% Significance Level                                                                                           |   |   |        |                                                |   |   |   |        |       |  |
| 233 |                                                                                                                                          |   |   |        |                                                |   |   |   |        |       |  |
| 234 | Lognormal Statistics                                                                                                                     |   |   |        |                                                |   |   |   |        |       |  |
| 235 | Minimum of Logged Data                                                                                                                   |   |   | -2.674 | Mean of logged Data                            |   |   |   | -2.204 |       |  |
| 236 | Maximum of Logged Data                                                                                                                   |   |   | -1.897 | SD of logged Data                              |   |   |   | 0.413  |       |  |
| 237 |                                                                                                                                          |   |   |        |                                                |   |   |   |        |       |  |
| 238 | Assuming Lognormal Distribution                                                                                                          |   |   |        |                                                |   |   |   |        |       |  |
| 239 | 95% H-UCL                                                                                                                                |   |   | 0.579  | 90% Chebyshev (MVUE) UCL                       |   |   |   | 0.199  |       |  |
| 240 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 0.236  | 97.5% Chebyshev (MVUE) UCL                     |   |   |   | 0.287  |       |  |
| 241 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 0.388  |                                                |   |   |   |        |       |  |
| 242 |                                                                                                                                          |   |   |        |                                                |   |   |   |        |       |  |
| 243 | Nonparametric Distribution Free UCL Statistics                                                                                           |   |   |        |                                                |   |   |   |        |       |  |
| 244 | Data appear to follow a Discernible Distribution at 5% Significance Level                                                                |   |   |        |                                                |   |   |   |        |       |  |
| 245 |                                                                                                                                          |   |   |        |                                                |   |   |   |        |       |  |
| 246 | Nonparametric Distribution Free UCLs                                                                                                     |   |   |        |                                                |   |   |   |        |       |  |
| 247 | 95% CLT UCL                                                                                                                              |   |   | 0.156  | 95% Jackknife UCL                              |   |   |   | 0.187  |       |  |
| 248 | 95% Standard Bootstrap UCL                                                                                                               |   |   | N/A    | 95% Bootstrap-t UCL                            |   |   |   | N/A    |       |  |
| 249 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | N/A    | 95% Percentile Bootstrap UCL                   |   |   |   | N/A    |       |  |
| 250 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | N/A    |                                                |   |   |   |        |       |  |
| 251 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 0.189  | 95% Chebyshev(Mean, Sd) UCL                    |   |   |   | 0.223  |       |  |
| 252 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 0.268  | 99% Chebyshev(Mean, Sd) UCL                    |   |   |   | 0.359  |       |  |
| 253 |                                                                                                                                          |   |   |        |                                                |   |   |   |        |       |  |
| 254 | Suggested UCL to Use                                                                                                                     |   |   |        |                                                |   |   |   |        |       |  |
| 255 | 95% Student's-t UCL                                                                                                                      |   |   | 0.187  |                                                |   |   |   |        |       |  |
| 256 |                                                                                                                                          |   |   |        |                                                |   |   |   |        |       |  |
| 257 | Recommended UCL exceeds the maximum observation                                                                                          |   |   |        |                                                |   |   |   |        |       |  |
| 258 |                                                                                                                                          |   |   |        |                                                |   |   |   |        |       |  |
| 259 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                |   |   |   |        |       |  |
| 260 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                |   |   |   |        |       |  |
| 261 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                |   |   |   |        |       |  |
| 262 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                |   |   |   |        |       |  |
| 263 |                                                                                                                                          |   |   |        |                                                |   |   |   |        |       |  |
| 264 | Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be                        |   |   |        |                                                |   |   |   |        |       |  |
| 265 | reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.                                              |   |   |        |                                                |   |   |   |        |       |  |
| 266 |                                                                                                                                          |   |   |        |                                                |   |   |   |        |       |  |
| 267 | Result (eu3_arsenic)                                                                                                                     |   |   |        |                                                |   |   |   |        |       |  |
| 268 |                                                                                                                                          |   |   |        |                                                |   |   |   |        |       |  |

| A   | B                                                                                                                                 | C | D | E       | F                                              | G | H | I      | J | K | L |  |
|-----|-----------------------------------------------------------------------------------------------------------------------------------|---|---|---------|------------------------------------------------|---|---|--------|---|---|---|--|
| 269 | <b>General Statistics</b>                                                                                                         |   |   |         |                                                |   |   |        |   |   |   |  |
| 270 | Total Number of Observations                                                                                                      |   |   | 3       | Number of Distinct Observations                |   |   | 1      |   |   |   |  |
| 271 | Number of Detects                                                                                                                 |   |   | 0       | Number of Non-Detects                          |   |   | 3      |   |   |   |  |
| 272 | Number of Distinct Detects                                                                                                        |   |   | 0       | Number of Distinct Non-Detects                 |   |   | 1      |   |   |   |  |
| 273 |                                                                                                                                   |   |   |         |                                                |   |   |        |   |   |   |  |
| 274 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                |   |   |         |                                                |   |   |        |   |   |   |  |
| 275 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>          |   |   |         |                                                |   |   |        |   |   |   |  |
| 276 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b> |   |   |         |                                                |   |   |        |   |   |   |  |
| 277 |                                                                                                                                   |   |   |         |                                                |   |   |        |   |   |   |  |
| 278 | <b>The data set for variable Result (eu3_arsenic) was not processed!</b>                                                          |   |   |         |                                                |   |   |        |   |   |   |  |
| 279 |                                                                                                                                   |   |   |         |                                                |   |   |        |   |   |   |  |
| 280 |                                                                                                                                   |   |   |         |                                                |   |   |        |   |   |   |  |
| 281 |                                                                                                                                   |   |   |         |                                                |   |   |        |   |   |   |  |
| 282 | <b>Result (eu3_chromium)</b>                                                                                                      |   |   |         |                                                |   |   |        |   |   |   |  |
| 283 |                                                                                                                                   |   |   |         |                                                |   |   |        |   |   |   |  |
| 284 | <b>General Statistics</b>                                                                                                         |   |   |         |                                                |   |   |        |   |   |   |  |
| 285 | Total Number of Observations                                                                                                      |   |   | 3       | Number of Distinct Observations                |   |   | 3      |   |   |   |  |
| 286 |                                                                                                                                   |   |   |         | Number of Missing Observations                 |   |   | 0      |   |   |   |  |
| 287 | Minimum                                                                                                                           |   |   | 0.17    | Mean                                           |   |   | 0.193  |   |   |   |  |
| 288 | Maximum                                                                                                                           |   |   | 0.22    | Median                                         |   |   | 0.19   |   |   |   |  |
| 289 | SD                                                                                                                                |   |   | 0.0252  | Std. Error of Mean                             |   |   | 0.0145 |   |   |   |  |
| 290 | Coefficient of Variation                                                                                                          |   |   | 0.13    | Skewness                                       |   |   | 0.586  |   |   |   |  |
| 291 |                                                                                                                                   |   |   |         |                                                |   |   |        |   |   |   |  |
| 292 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                        |   |   |         |                                                |   |   |        |   |   |   |  |
| 293 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                            |   |   |         |                                                |   |   |        |   |   |   |  |
| 294 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                               |   |   |         |                                                |   |   |        |   |   |   |  |
| 295 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                    |   |   |         |                                                |   |   |        |   |   |   |  |
| 296 |                                                                                                                                   |   |   |         |                                                |   |   |        |   |   |   |  |
| 297 | <b>Normal GOF Test</b>                                                                                                            |   |   |         |                                                |   |   |        |   |   |   |  |
| 298 | Shapiro Wilk Test Statistic                                                                                                       |   |   | 0.987   | <b>Shapiro Wilk GOF Test</b>                   |   |   |        |   |   |   |  |
| 299 | 5% Shapiro Wilk Critical Value                                                                                                    |   |   | 0.767   | Data appear Normal at 5% Significance Level    |   |   |        |   |   |   |  |
| 300 | Lilliefors Test Statistic                                                                                                         |   |   | 0.219   | <b>Lilliefors GOF Test</b>                     |   |   |        |   |   |   |  |
| 301 | 5% Lilliefors Critical Value                                                                                                      |   |   | 0.425   | Data appear Normal at 5% Significance Level    |   |   |        |   |   |   |  |
| 302 | <b>Data appear Normal at 5% Significance Level</b>                                                                                |   |   |         |                                                |   |   |        |   |   |   |  |
| 303 |                                                                                                                                   |   |   |         |                                                |   |   |        |   |   |   |  |
| 304 | <b>Assuming Normal Distribution</b>                                                                                               |   |   |         |                                                |   |   |        |   |   |   |  |
| 305 | <b>95% Normal UCL</b>                                                                                                             |   |   |         | <b>95% UCLs (Adjusted for Skewness)</b>        |   |   |        |   |   |   |  |
| 306 | 95% Student's-t UCL                                                                                                               |   |   | 0.236   | 95% Adjusted-CLT UCL (Chen-1995)               |   |   | 0.222  |   |   |   |  |
| 307 |                                                                                                                                   |   |   |         | 95% Modified-t UCL (Johnson-1978)              |   |   | 0.237  |   |   |   |  |
| 308 |                                                                                                                                   |   |   |         |                                                |   |   |        |   |   |   |  |
| 309 | <b>Gamma GOF Test</b>                                                                                                             |   |   |         |                                                |   |   |        |   |   |   |  |
| 310 | <b>Not Enough Data to Perform GOF Test</b>                                                                                        |   |   |         |                                                |   |   |        |   |   |   |  |
| 311 |                                                                                                                                   |   |   |         |                                                |   |   |        |   |   |   |  |
| 312 | <b>Gamma Statistics</b>                                                                                                           |   |   |         |                                                |   |   |        |   |   |   |  |
| 313 | k hat (MLE)                                                                                                                       |   |   | 89.47   | k star (bias corrected MLE)                    |   |   | N/A    |   |   |   |  |
| 314 | Theta hat (MLE)                                                                                                                   |   |   | 0.00216 | Theta star (bias corrected MLE)                |   |   | N/A    |   |   |   |  |
| 315 | nu hat (MLE)                                                                                                                      |   |   | 536.8   | nu star (bias corrected)                       |   |   | N/A    |   |   |   |  |
| 316 | MLE Mean (bias corrected)                                                                                                         |   |   | N/A     | MLE Sd (bias corrected)                        |   |   | N/A    |   |   |   |  |
| 317 |                                                                                                                                   |   |   |         | Approximate Chi Square Value (0.05)            |   |   | N/A    |   |   |   |  |
| 318 | Adjusted Level of Significance                                                                                                    |   |   | N/A     | Adjusted Chi Square Value                      |   |   | N/A    |   |   |   |  |
| 319 |                                                                                                                                   |   |   |         |                                                |   |   |        |   |   |   |  |
| 320 | <b>Assuming Gamma Distribution</b>                                                                                                |   |   |         |                                                |   |   |        |   |   |   |  |
| 321 | 95% Approximate Gamma UCL (use when n>=50))                                                                                       |   |   | N/A     | 95% Adjusted Gamma UCL (use when n<50)         |   |   | N/A    |   |   |   |  |
| 322 |                                                                                                                                   |   |   |         |                                                |   |   |        |   |   |   |  |
| 323 | <b>Lognormal GOF Test</b>                                                                                                         |   |   |         |                                                |   |   |        |   |   |   |  |
| 324 | Shapiro Wilk Test Statistic                                                                                                       |   |   | 0.994   | <b>Shapiro Wilk Lognormal GOF Test</b>         |   |   |        |   |   |   |  |
| 325 | 5% Shapiro Wilk Critical Value                                                                                                    |   |   | 0.767   | Data appear Lognormal at 5% Significance Level |   |   |        |   |   |   |  |
| 326 | Lilliefors Test Statistic                                                                                                         |   |   | 0.203   | <b>Lilliefors Lognormal GOF Test</b>           |   |   |        |   |   |   |  |
| 327 | 5% Lilliefors Critical Value                                                                                                      |   |   | 0.425   | Data appear Lognormal at 5% Significance Level |   |   |        |   |   |   |  |
| 328 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                             |   |   |         |                                                |   |   |        |   |   |   |  |
| 329 |                                                                                                                                   |   |   |         |                                                |   |   |        |   |   |   |  |
| 330 | <b>Lognormal Statistics</b>                                                                                                       |   |   |         |                                                |   |   |        |   |   |   |  |
| 331 | Minimum of Logged Data                                                                                                            |   |   | -1.772  | Mean of logged Data                            |   |   | -1.649 |   |   |   |  |
| 332 | Maximum of Logged Data                                                                                                            |   |   | -1.514  | SD of logged Data                              |   |   | 0.129  |   |   |   |  |
| 333 |                                                                                                                                   |   |   |         |                                                |   |   |        |   |   |   |  |
| 334 | <b>Assuming Lognormal Distribution</b>                                                                                            |   |   |         |                                                |   |   |        |   |   |   |  |
| 335 | 95% H-UCL                                                                                                                         |   |   | 0.252   | 90% Chebyshev (MVUE) UCL                       |   |   | 0.237  |   |   |   |  |

|     |                                                                                                                                          |                               |        |  |                                   |        |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|--------|--|-----------------------------------|--------|
| 336 |                                                                                                                                          | 95% Chebyshev (MVUE) UCL      | 0.256  |  | 97.5% Chebyshev (MVUE) UCL        | 0.283  |
| 337 |                                                                                                                                          | 99% Chebyshev (MVUE) UCL      | 0.337  |  |                                   |        |
| 338 |                                                                                                                                          |                               |        |  |                                   |        |
| 339 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |                               |        |  |                                   |        |
| 340 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |                               |        |  |                                   |        |
| 341 |                                                                                                                                          |                               |        |  |                                   |        |
| 342 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |                               |        |  |                                   |        |
| 343 |                                                                                                                                          | 95% CLT UCL                   | 0.217  |  | 95% Jackknife UCL                 | 0.236  |
| 344 |                                                                                                                                          | 95% Standard Bootstrap UCL    | N/A    |  | 95% Bootstrap-t UCL               | N/A    |
| 345 |                                                                                                                                          | 95% Hall's Bootstrap UCL      | N/A    |  | 95% Percentile Bootstrap UCL      | N/A    |
| 346 |                                                                                                                                          | 95% BCA Bootstrap UCL         | N/A    |  |                                   |        |
| 347 |                                                                                                                                          | 90% Chebyshev(Mean, Sd) UCL   | 0.237  |  | 95% Chebyshev(Mean, Sd) UCL       | 0.257  |
| 348 |                                                                                                                                          | 97.5% Chebyshev(Mean, Sd) UCL | 0.284  |  | 99% Chebyshev(Mean, Sd) UCL       | 0.338  |
| 349 |                                                                                                                                          |                               |        |  |                                   |        |
| 350 | <b>Suggested UCL to Use</b>                                                                                                              |                               |        |  |                                   |        |
| 351 |                                                                                                                                          | 95% Student's-t UCL           | 0.236  |  |                                   |        |
| 352 |                                                                                                                                          |                               |        |  |                                   |        |
| 353 | <b>Recommended UCL exceeds the maximum observation</b>                                                                                   |                               |        |  |                                   |        |
| 354 |                                                                                                                                          |                               |        |  |                                   |        |
| 355 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |                               |        |  |                                   |        |
| 356 | Recommendations are based upon data size, data distribution, and skewness.                                                               |                               |        |  |                                   |        |
| 357 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |                               |        |  |                                   |        |
| 358 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |                               |        |  |                                   |        |
| 359 |                                                                                                                                          |                               |        |  |                                   |        |
| 360 | <b>Result (eu3_lead)</b>                                                                                                                 |                               |        |  |                                   |        |
| 361 |                                                                                                                                          |                               |        |  |                                   |        |
| 362 | <b>General Statistics</b>                                                                                                                |                               |        |  |                                   |        |
| 363 |                                                                                                                                          | Total Number of Observations  | 3      |  | Number of Distinct Observations   | 3      |
| 364 |                                                                                                                                          | Number of Detects             | 2      |  | Number of Non-Detects             | 1      |
| 365 |                                                                                                                                          | Number of Distinct Detects    | 2      |  | Number of Distinct Non-Detects    | 1      |
| 366 |                                                                                                                                          | Minimum Detect                | 0.026  |  | Minimum Non-Detect                | 0.0094 |
| 367 |                                                                                                                                          | Maximum Detect                | 0.19   |  | Maximum Non-Detect                | 0.0094 |
| 368 |                                                                                                                                          | Variance Detects              | 0.0134 |  | Percent Non-Detects               | 33.33% |
| 369 |                                                                                                                                          | Mean Detects                  | 0.108  |  | SD Detects                        | 0.116  |
| 370 |                                                                                                                                          | Median Detects                | 0.108  |  | CV Detects                        | 1.074  |
| 371 |                                                                                                                                          | Skewness Detects              | N/A    |  | Kurtosis Detects                  | N/A    |
| 372 |                                                                                                                                          | Mean of Logged Detects        | -2.655 |  | SD of Logged Detects              | 1.406  |
| 373 |                                                                                                                                          |                               |        |  |                                   |        |
| 374 | <b>Warning: Data set has only 2 Detected Values.</b>                                                                                     |                               |        |  |                                   |        |
| 375 | <b>This is not enough to compute meaningful or reliable statistics and estimates.</b>                                                    |                               |        |  |                                   |        |
| 376 |                                                                                                                                          |                               |        |  |                                   |        |
| 377 |                                                                                                                                          |                               |        |  |                                   |        |
| 378 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |                               |        |  |                                   |        |
| 379 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |                               |        |  |                                   |        |
| 380 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |                               |        |  |                                   |        |
| 381 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |                               |        |  |                                   |        |
| 382 |                                                                                                                                          |                               |        |  |                                   |        |
| 383 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |                               |        |  |                                   |        |
| 384 | <b>Not Enough Data to Perform GOF Test</b>                                                                                               |                               |        |  |                                   |        |
| 385 |                                                                                                                                          |                               |        |  |                                   |        |
| 386 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |                               |        |  |                                   |        |
| 387 |                                                                                                                                          | KM Mean                       | 0.0751 |  | KM Standard Error of Mean         | 0.0665 |
| 388 |                                                                                                                                          | KM SD                         | 0.0815 |  | 95% KM (BCA) UCL                  | N/A    |
| 389 |                                                                                                                                          | 95% KM (t) UCL                | 0.269  |  | 95% KM (Percentile Bootstrap) UCL | N/A    |
| 390 |                                                                                                                                          | 95% KM (z) UCL                | 0.185  |  | 95% KM Bootstrap t UCL            | N/A    |
| 391 |                                                                                                                                          | 90% KM Chebyshev UCL          | 0.275  |  | 95% KM Chebyshev UCL              | 0.365  |
| 392 |                                                                                                                                          | 97.5% KM Chebyshev UCL        | 0.491  |  | 99% KM Chebyshev UCL              | 0.737  |
| 393 |                                                                                                                                          |                               |        |  |                                   |        |
| 394 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |                               |        |  |                                   |        |
| 395 | <b>Not Enough Data to Perform GOF Test</b>                                                                                               |                               |        |  |                                   |        |
| 396 |                                                                                                                                          |                               |        |  |                                   |        |
| 397 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |                               |        |  |                                   |        |
| 398 |                                                                                                                                          | k hat (MLE)                   | 1.305  |  | k star (bias corrected MLE)       | N/A    |
| 399 |                                                                                                                                          | Theta hat (MLE)               | 0.0827 |  | Theta star (bias corrected MLE)   | N/A    |
| 400 |                                                                                                                                          | nu hat (MLE)                  | 5.222  |  | nu star (bias corrected)          | N/A    |
| 401 |                                                                                                                                          | Mean (detects)                | 0.108  |  |                                   |        |
| 402 |                                                                                                                                          |                               |        |  |                                   |        |

| A   | B                                                                                                                                        | C        | D                                              | E         | F | G                           | H | I | J | K | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|----------|------------------------------------------------|-----------|---|-----------------------------|---|---|---|---|---|
| 403 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |          |                                                |           |   |                             |   |   |   |   |   |
| 404 | Mean (KM)                                                                                                                                | 0.0751   | SD (KM)                                        | 0.0815    |   |                             |   |   |   |   |   |
| 405 | Variance (KM)                                                                                                                            | 0.00664  | SE of Mean (KM)                                | 0.0665    |   |                             |   |   |   |   |   |
| 406 | k hat (KM)                                                                                                                               | 0.85     | k star (KM)                                    | N/A       |   |                             |   |   |   |   |   |
| 407 | nu hat (KM)                                                                                                                              | 5.099    | nu star (KM)                                   | N/A       |   |                             |   |   |   |   |   |
| 408 | theta hat (KM)                                                                                                                           | 0.0884   | theta star (KM)                                | N/A       |   |                             |   |   |   |   |   |
| 409 | 80% gamma percentile (KM)                                                                                                                | N/A      | 90% gamma percentile (KM)                      | N/A       |   |                             |   |   |   |   |   |
| 410 | 95% gamma percentile (KM)                                                                                                                | N/A      | 99% gamma percentile (KM)                      | N/A       |   |                             |   |   |   |   |   |
| 411 |                                                                                                                                          |          |                                                |           |   |                             |   |   |   |   |   |
| 412 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |          |                                                |           |   |                             |   |   |   |   |   |
| 413 |                                                                                                                                          |          | Adjusted Level of Significance ( $\beta$ )     | 0.00136   |   |                             |   |   |   |   |   |
| 414 | Approximate Chi Square Value (N/A, $\alpha$ )                                                                                            | N/A      | Adjusted Chi Square Value (N/A, $\beta$ )      | N/A       |   |                             |   |   |   |   |   |
| 415 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                      | N/A      | 95% Gamma Adjusted KM-UCL (use when $n < 50$ ) | N/A       |   |                             |   |   |   |   |   |
| 416 |                                                                                                                                          |          |                                                |           |   |                             |   |   |   |   |   |
| 417 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |          |                                                |           |   |                             |   |   |   |   |   |
| 418 | <b>Not Enough Data to Perform GOF Test</b>                                                                                               |          |                                                |           |   |                             |   |   |   |   |   |
| 419 |                                                                                                                                          |          |                                                |           |   |                             |   |   |   |   |   |
| 420 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |          |                                                |           |   |                             |   |   |   |   |   |
| 421 | Mean in Original Scale                                                                                                                   | 0.0723   | Mean in Log Scale                              | -4.161    |   |                             |   |   |   |   |   |
| 422 | SD in Original Scale                                                                                                                     | 0.103    | SD in Log Scale                                | 2.791     |   |                             |   |   |   |   |   |
| 423 | 95% t UCL (assumes normality of ROS data)                                                                                                | 0.245    | 95% Percentile Bootstrap UCL                   | N/A       |   |                             |   |   |   |   |   |
| 424 | 95% BCA Bootstrap UCL                                                                                                                    | N/A      | 95% Bootstrap t UCL                            | N/A       |   |                             |   |   |   |   |   |
| 425 | 95% H-UCL (Log ROS)                                                                                                                      | 1.501E+3 |                                                |           |   |                             |   |   |   |   |   |
| 426 |                                                                                                                                          |          |                                                |           |   |                             |   |   |   |   |   |
| 427 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |          |                                                |           |   |                             |   |   |   |   |   |
| 428 | KM Mean (logged)                                                                                                                         | -3.326   | KM Geo Mean                                    | 0.0359    |   |                             |   |   |   |   |   |
| 429 | KM SD (logged)                                                                                                                           | 1.249    | 95% Critical H Value (KM-Log)                  | 16.31     |   |                             |   |   |   |   |   |
| 430 | KM Standard Error of Mean (logged)                                                                                                       | 1.019    | 95% H-UCL (KM -Log)                            | 140468    |   |                             |   |   |   |   |   |
| 431 | KM SD (logged)                                                                                                                           | 1.249    | 95% Critical H Value (KM-Log)                  | 16.31     |   |                             |   |   |   |   |   |
| 432 | KM Standard Error of Mean (logged)                                                                                                       | 1.019    |                                                |           |   |                             |   |   |   |   |   |
| 433 |                                                                                                                                          |          |                                                |           |   |                             |   |   |   |   |   |
| 434 | <b>DL/2 Statistics</b>                                                                                                                   |          |                                                |           |   |                             |   |   |   |   |   |
| 435 | <b>DL/2 Normal</b>                                                                                                                       |          |                                                |           |   | <b>DL/2 Log-Transformed</b> |   |   |   |   |   |
| 436 | Mean in Original Scale                                                                                                                   | 0.0736   | Mean in Log Scale                              | -3.557    |   |                             |   |   |   |   |   |
| 437 | SD in Original Scale                                                                                                                     | 0.101    | SD in Log Scale                                | 1.851     |   |                             |   |   |   |   |   |
| 438 | 95% t UCL (Assumes normality)                                                                                                            | 0.245    | 95% H-Stat UCL                                 | 9.070E+12 |   |                             |   |   |   |   |   |
| 439 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |          |                                                |           |   |                             |   |   |   |   |   |
| 440 |                                                                                                                                          |          |                                                |           |   |                             |   |   |   |   |   |
| 441 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |          |                                                |           |   |                             |   |   |   |   |   |
| 442 | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                            |          |                                                |           |   |                             |   |   |   |   |   |
| 443 |                                                                                                                                          |          |                                                |           |   |                             |   |   |   |   |   |
| 444 | <b>Suggested UCL to Use</b>                                                                                                              |          |                                                |           |   |                             |   |   |   |   |   |
| 445 | 95% KM (Chebyshev) UCL                                                                                                                   | 0.365    |                                                |           |   |                             |   |   |   |   |   |
| 446 | <b>Warning: Recommended UCL exceeds the maximum observation</b>                                                                          |          |                                                |           |   |                             |   |   |   |   |   |
| 447 |                                                                                                                                          |          |                                                |           |   |                             |   |   |   |   |   |
| 448 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |          |                                                |           |   |                             |   |   |   |   |   |
| 449 | Recommendations are based upon data size, data distribution, and skewness.                                                               |          |                                                |           |   |                             |   |   |   |   |   |
| 450 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |          |                                                |           |   |                             |   |   |   |   |   |
| 451 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |          |                                                |           |   |                             |   |   |   |   |   |
| 452 |                                                                                                                                          |          |                                                |           |   |                             |   |   |   |   |   |
| 453 |                                                                                                                                          |          |                                                |           |   |                             |   |   |   |   |   |
| 454 | <b>Result (eu3_manganese)</b>                                                                                                            |          |                                                |           |   |                             |   |   |   |   |   |
| 455 |                                                                                                                                          |          |                                                |           |   |                             |   |   |   |   |   |
| 456 | <b>General Statistics</b>                                                                                                                |          |                                                |           |   |                             |   |   |   |   |   |
| 457 | Total Number of Observations                                                                                                             | 3        | Number of Distinct Observations                | 3         |   |                             |   |   |   |   |   |
| 458 |                                                                                                                                          |          | Number of Missing Observations                 | 0         |   |                             |   |   |   |   |   |
| 459 | Minimum                                                                                                                                  | 0.022    | Mean                                           | 0.144     |   |                             |   |   |   |   |   |
| 460 | Maximum                                                                                                                                  | 0.37     | Median                                         | 0.041     |   |                             |   |   |   |   |   |
| 461 | SD                                                                                                                                       | 0.196    | Std. Error of Mean                             | 0.113     |   |                             |   |   |   |   |   |
| 462 | Coefficient of Variation                                                                                                                 | 1.356    | Skewness                                       | 1.714     |   |                             |   |   |   |   |   |
| 463 |                                                                                                                                          |          |                                                |           |   |                             |   |   |   |   |   |
| 464 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |          |                                                |           |   |                             |   |   |   |   |   |
| 465 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |          |                                                |           |   |                             |   |   |   |   |   |
| 466 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |          |                                                |           |   |                             |   |   |   |   |   |
| 467 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |          |                                                |           |   |                             |   |   |   |   |   |
| 468 |                                                                                                                                          |          |                                                |           |   |                             |   |   |   |   |   |
| 469 | <b>Normal GOF Test</b>                                                                                                                   |          |                                                |           |   |                             |   |   |   |   |   |

| A   | B                                                                                                                                        | C | D | E        | F                                              | G | H | I      | J | K     | L |  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---|----------|------------------------------------------------|---|---|--------|---|-------|---|--|
| 470 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.791    | Shapiro Wilk GOF Test                          |   |   |        |   |       |   |  |
| 471 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.767    | Data appear Normal at 5% Significance Level    |   |   |        |   |       |   |  |
| 472 | Lilliefors Test Statistic                                                                                                                |   |   | 0.368    | Lilliefors GOF Test                            |   |   |        |   |       |   |  |
| 473 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.425    | Data appear Normal at 5% Significance Level    |   |   |        |   |       |   |  |
| 474 | Data appear Normal at 5% Significance Level                                                                                              |   |   |          |                                                |   |   |        |   |       |   |  |
| 475 |                                                                                                                                          |   |   |          |                                                |   |   |        |   |       |   |  |
| 476 | Assuming Normal Distribution                                                                                                             |   |   |          |                                                |   |   |        |   |       |   |  |
| 477 | 95% Normal UCL                                                                                                                           |   |   |          | 95% UCLs (Adjusted for Skewness)               |   |   |        |   |       |   |  |
| 478 | 95% Student's-t UCL                                                                                                                      |   |   | 0.474    | 95% Adjusted-CLT UCL (Chen-1995)               |   |   |        |   | 0.45  |   |  |
| 479 |                                                                                                                                          |   |   |          | 95% Modified-t UCL (Johnson-1978)              |   |   |        |   | 0.493 |   |  |
| 480 |                                                                                                                                          |   |   |          |                                                |   |   |        |   |       |   |  |
| 481 | Gamma GOF Test                                                                                                                           |   |   |          |                                                |   |   |        |   |       |   |  |
| 482 | Not Enough Data to Perform GOF Test                                                                                                      |   |   |          |                                                |   |   |        |   |       |   |  |
| 483 |                                                                                                                                          |   |   |          |                                                |   |   |        |   |       |   |  |
| 484 | Gamma Statistics                                                                                                                         |   |   |          |                                                |   |   |        |   |       |   |  |
| 485 | k hat (MLE)                                                                                                                              |   |   | 0.809    | k star (bias corrected MLE)                    |   |   | N/A    |   |       |   |  |
| 486 | Theta hat (MLE)                                                                                                                          |   |   | 0.178    | Theta star (bias corrected MLE)                |   |   | N/A    |   |       |   |  |
| 487 | nu hat (MLE)                                                                                                                             |   |   | 4.853    | nu star (bias corrected)                       |   |   | N/A    |   |       |   |  |
| 488 | MLE Mean (bias corrected)                                                                                                                |   |   | N/A      | MLE Sd (bias corrected)                        |   |   | N/A    |   |       |   |  |
| 489 |                                                                                                                                          |   |   |          | Approximate Chi Square Value (0.05)            |   |   | N/A    |   |       |   |  |
| 490 | Adjusted Level of Significance                                                                                                           |   |   | N/A      | Adjusted Chi Square Value                      |   |   | N/A    |   |       |   |  |
| 491 |                                                                                                                                          |   |   |          |                                                |   |   |        |   |       |   |  |
| 492 | Assuming Gamma Distribution                                                                                                              |   |   |          |                                                |   |   |        |   |       |   |  |
| 493 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |   | N/A      | 95% Adjusted Gamma UCL (use when n<50)         |   |   | N/A    |   |       |   |  |
| 494 |                                                                                                                                          |   |   |          |                                                |   |   |        |   |       |   |  |
| 495 | Lognormal GOF Test                                                                                                                       |   |   |          |                                                |   |   |        |   |       |   |  |
| 496 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.906    | Shapiro Wilk Lognormal GOF Test                |   |   |        |   |       |   |  |
| 497 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.767    | Data appear Lognormal at 5% Significance Level |   |   |        |   |       |   |  |
| 498 | Lilliefors Test Statistic                                                                                                                |   |   | 0.305    | Lilliefors Lognormal GOF Test                  |   |   |        |   |       |   |  |
| 499 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.425    | Data appear Lognormal at 5% Significance Level |   |   |        |   |       |   |  |
| 500 | Data appear Lognormal at 5% Significance Level                                                                                           |   |   |          |                                                |   |   |        |   |       |   |  |
| 501 |                                                                                                                                          |   |   |          |                                                |   |   |        |   |       |   |  |
| 502 | Lognormal Statistics                                                                                                                     |   |   |          |                                                |   |   |        |   |       |   |  |
| 503 | Minimum of Logged Data                                                                                                                   |   |   | -3.817   | Mean of logged Data                            |   |   | -2.668 |   |       |   |  |
| 504 | Maximum of Logged Data                                                                                                                   |   |   | -0.994   | SD of logged Data                              |   |   | 1.483  |   |       |   |  |
| 505 |                                                                                                                                          |   |   |          |                                                |   |   |        |   |       |   |  |
| 506 | Assuming Lognormal Distribution                                                                                                          |   |   |          |                                                |   |   |        |   |       |   |  |
| 507 | 95% H-UCL                                                                                                                                |   |   | 1.387E+8 | 90% Chebyshev (MVUE) UCL                       |   |   | 0.398  |   |       |   |  |
| 508 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 0.519    | 97.5% Chebyshev (MVUE) UCL                     |   |   | 0.687  |   |       |   |  |
| 509 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 1.017    |                                                |   |   |        |   |       |   |  |
| 510 |                                                                                                                                          |   |   |          |                                                |   |   |        |   |       |   |  |
| 511 | Nonparametric Distribution Free UCL Statistics                                                                                           |   |   |          |                                                |   |   |        |   |       |   |  |
| 512 | Data appear to follow a Discernible Distribution at 5% Significance Level                                                                |   |   |          |                                                |   |   |        |   |       |   |  |
| 513 |                                                                                                                                          |   |   |          |                                                |   |   |        |   |       |   |  |
| 514 | Nonparametric Distribution Free UCLs                                                                                                     |   |   |          |                                                |   |   |        |   |       |   |  |
| 515 | 95% CLT UCL                                                                                                                              |   |   | 0.33     | 95% Jackknife UCL                              |   |   | 0.474  |   |       |   |  |
| 516 | 95% Standard Bootstrap UCL                                                                                                               |   |   | N/A      | 95% Bootstrap-t UCL                            |   |   | N/A    |   |       |   |  |
| 517 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | N/A      | 95% Percentile Bootstrap UCL                   |   |   | N/A    |   |       |   |  |
| 518 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | N/A      |                                                |   |   |        |   |       |   |  |
| 519 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 0.483    | 95% Chebyshev(Mean, Sd) UCL                    |   |   | 0.637  |   |       |   |  |
| 520 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 0.85     | 99% Chebyshev(Mean, Sd) UCL                    |   |   | 1.268  |   |       |   |  |
| 521 |                                                                                                                                          |   |   |          |                                                |   |   |        |   |       |   |  |
| 522 | Suggested UCL to Use                                                                                                                     |   |   |          |                                                |   |   |        |   |       |   |  |
| 523 | 95% Student's-t UCL                                                                                                                      |   |   | 0.474    |                                                |   |   |        |   |       |   |  |
| 524 |                                                                                                                                          |   |   |          |                                                |   |   |        |   |       |   |  |
| 525 | Recommended UCL exceeds the maximum observation                                                                                          |   |   |          |                                                |   |   |        |   |       |   |  |
| 526 |                                                                                                                                          |   |   |          |                                                |   |   |        |   |       |   |  |
| 527 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |          |                                                |   |   |        |   |       |   |  |
| 528 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |          |                                                |   |   |        |   |       |   |  |
| 529 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |          |                                                |   |   |        |   |       |   |  |
| 530 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |          |                                                |   |   |        |   |       |   |  |
| 531 |                                                                                                                                          |   |   |          |                                                |   |   |        |   |       |   |  |
| 532 | Result (eu4_arsenic)                                                                                                                     |   |   |          |                                                |   |   |        |   |       |   |  |
| 533 |                                                                                                                                          |   |   |          |                                                |   |   |        |   |       |   |  |
| 534 | General Statistics                                                                                                                       |   |   |          |                                                |   |   |        |   |       |   |  |
| 535 | Total Number of Observations                                                                                                             |   |   | 3        | Number of Distinct Observations                |   |   | 2      |   |       |   |  |
| 536 | Number of Detects                                                                                                                        |   |   | 0        | Number of Non-Detects                          |   |   | 3      |   |       |   |  |

| A   | B                                                                                                                                 | C | D | E                                       | F                                              | G | H | I       | J | K | L |
|-----|-----------------------------------------------------------------------------------------------------------------------------------|---|---|-----------------------------------------|------------------------------------------------|---|---|---------|---|---|---|
| 537 | Number of Distinct Detects                                                                                                        |   |   | 0                                       | Number of Distinct Non-Detects                 |   |   | 2       |   |   |   |
| 538 |                                                                                                                                   |   |   |                                         |                                                |   |   |         |   |   |   |
| 539 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                |   |   |                                         |                                                |   |   |         |   |   |   |
| 540 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>          |   |   |                                         |                                                |   |   |         |   |   |   |
| 541 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b> |   |   |                                         |                                                |   |   |         |   |   |   |
| 542 |                                                                                                                                   |   |   |                                         |                                                |   |   |         |   |   |   |
| 543 | <b>The data set for variable Result (eu4_arsenic) was not processed!</b>                                                          |   |   |                                         |                                                |   |   |         |   |   |   |
| 544 |                                                                                                                                   |   |   |                                         |                                                |   |   |         |   |   |   |
| 545 |                                                                                                                                   |   |   |                                         |                                                |   |   |         |   |   |   |
| 546 |                                                                                                                                   |   |   |                                         |                                                |   |   |         |   |   |   |
| 547 | <b>Result (eu4_chromium)</b>                                                                                                      |   |   |                                         |                                                |   |   |         |   |   |   |
| 548 |                                                                                                                                   |   |   |                                         |                                                |   |   |         |   |   |   |
| 549 | <b>General Statistics</b>                                                                                                         |   |   |                                         |                                                |   |   |         |   |   |   |
| 550 | Total Number of Observations                                                                                                      |   |   | 3                                       | Number of Distinct Observations                |   |   | 3       |   |   |   |
| 551 |                                                                                                                                   |   |   |                                         | Number of Missing Observations                 |   |   | 0       |   |   |   |
| 552 | Minimum                                                                                                                           |   |   | 0.2                                     | Mean                                           |   |   | 0.217   |   |   |   |
| 553 | Maximum                                                                                                                           |   |   | 0.23                                    | Median                                         |   |   | 0.22    |   |   |   |
| 554 | SD                                                                                                                                |   |   | 0.0153                                  | Std. Error of Mean                             |   |   | 0.00882 |   |   |   |
| 555 | Coefficient of Variation                                                                                                          |   |   | 0.0705                                  | Skewness                                       |   |   | -0.935  |   |   |   |
| 556 |                                                                                                                                   |   |   |                                         |                                                |   |   |         |   |   |   |
| 557 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                        |   |   |                                         |                                                |   |   |         |   |   |   |
| 558 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                            |   |   |                                         |                                                |   |   |         |   |   |   |
| 559 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                               |   |   |                                         |                                                |   |   |         |   |   |   |
| 560 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                    |   |   |                                         |                                                |   |   |         |   |   |   |
| 561 |                                                                                                                                   |   |   |                                         |                                                |   |   |         |   |   |   |
| 562 | <b>Normal GOF Test</b>                                                                                                            |   |   |                                         |                                                |   |   |         |   |   |   |
| 563 | Shapiro Wilk Test Statistic                                                                                                       |   |   | 0.964                                   | <b>Shapiro Wilk GOF Test</b>                   |   |   |         |   |   |   |
| 564 | 5% Shapiro Wilk Critical Value                                                                                                    |   |   | 0.767                                   | Data appear Normal at 5% Significance Level    |   |   |         |   |   |   |
| 565 | Lilliefors Test Statistic                                                                                                         |   |   | 0.253                                   | <b>Lilliefors GOF Test</b>                     |   |   |         |   |   |   |
| 566 | 5% Lilliefors Critical Value                                                                                                      |   |   | 0.425                                   | Data appear Normal at 5% Significance Level    |   |   |         |   |   |   |
| 567 | <b>Data appear Normal at 5% Significance Level</b>                                                                                |   |   |                                         |                                                |   |   |         |   |   |   |
| 568 |                                                                                                                                   |   |   |                                         |                                                |   |   |         |   |   |   |
| 569 | <b>Assuming Normal Distribution</b>                                                                                               |   |   |                                         |                                                |   |   |         |   |   |   |
| 570 | <b>95% Normal UCL</b>                                                                                                             |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |                                                |   |   |         |   |   |   |
| 571 | 95% Student's-t UCL                                                                                                               |   |   | 0.242                                   | 95% Adjusted-CLT UCL (Chen-1995)               |   |   | 0.226   |   |   |   |
| 572 |                                                                                                                                   |   |   |                                         | 95% Modified-t UCL (Johnson-1978)              |   |   | 0.242   |   |   |   |
| 573 |                                                                                                                                   |   |   |                                         |                                                |   |   |         |   |   |   |
| 574 | <b>Gamma GOF Test</b>                                                                                                             |   |   |                                         |                                                |   |   |         |   |   |   |
| 575 | <b>Not Enough Data to Perform GOF Test</b>                                                                                        |   |   |                                         |                                                |   |   |         |   |   |   |
| 576 |                                                                                                                                   |   |   |                                         |                                                |   |   |         |   |   |   |
| 577 | <b>Gamma Statistics</b>                                                                                                           |   |   |                                         |                                                |   |   |         |   |   |   |
| 578 | k hat (MLE)                                                                                                                       |   |   | 296.8                                   | k star (bias corrected MLE)                    |   |   | N/A     |   |   |   |
| 579 | Theta hat (MLE)                                                                                                                   |   |   | 7.2990E-4                               | Theta star (bias corrected MLE)                |   |   | N/A     |   |   |   |
| 580 | nu hat (MLE)                                                                                                                      |   |   | 1781                                    | nu star (bias corrected)                       |   |   | N/A     |   |   |   |
| 581 | MLE Mean (bias corrected)                                                                                                         |   |   | N/A                                     | MLE Sd (bias corrected)                        |   |   | N/A     |   |   |   |
| 582 |                                                                                                                                   |   |   |                                         | Approximate Chi Square Value (0.05)            |   |   | N/A     |   |   |   |
| 583 | Adjusted Level of Significance                                                                                                    |   |   | N/A                                     | Adjusted Chi Square Value                      |   |   | N/A     |   |   |   |
| 584 |                                                                                                                                   |   |   |                                         |                                                |   |   |         |   |   |   |
| 585 | <b>Assuming Gamma Distribution</b>                                                                                                |   |   |                                         |                                                |   |   |         |   |   |   |
| 586 | 95% Approximate Gamma UCL (use when n>=50))                                                                                       |   |   | N/A                                     | 95% Adjusted Gamma UCL (use when n<50)         |   |   | N/A     |   |   |   |
| 587 |                                                                                                                                   |   |   |                                         |                                                |   |   |         |   |   |   |
| 588 | <b>Lognormal GOF Test</b>                                                                                                         |   |   |                                         |                                                |   |   |         |   |   |   |
| 589 | Shapiro Wilk Test Statistic                                                                                                       |   |   | 0.958                                   | <b>Shapiro Wilk Lognormal GOF Test</b>         |   |   |         |   |   |   |
| 590 | 5% Shapiro Wilk Critical Value                                                                                                    |   |   | 0.767                                   | Data appear Lognormal at 5% Significance Level |   |   |         |   |   |   |
| 591 | Lilliefors Test Statistic                                                                                                         |   |   | 0.26                                    | <b>Lilliefors Lognormal GOF Test</b>           |   |   |         |   |   |   |
| 592 | 5% Lilliefors Critical Value                                                                                                      |   |   | 0.425                                   | Data appear Lognormal at 5% Significance Level |   |   |         |   |   |   |
| 593 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                             |   |   |                                         |                                                |   |   |         |   |   |   |
| 594 |                                                                                                                                   |   |   |                                         |                                                |   |   |         |   |   |   |
| 595 | <b>Lognormal Statistics</b>                                                                                                       |   |   |                                         |                                                |   |   |         |   |   |   |
| 596 | Minimum of Logged Data                                                                                                            |   |   | -1.609                                  | Mean of logged Data                            |   |   | -1.531  |   |   |   |
| 597 | Maximum of Logged Data                                                                                                            |   |   | -1.47                                   | SD of logged Data                              |   |   | 0.0714  |   |   |   |
| 598 |                                                                                                                                   |   |   |                                         |                                                |   |   |         |   |   |   |
| 599 | <b>Assuming Lognormal Distribution</b>                                                                                            |   |   |                                         |                                                |   |   |         |   |   |   |
| 600 | 95% H-UCL                                                                                                                         |   |   | N/A                                     | 90% Chebyshev (MVUE) UCL                       |   |   | 0.243   |   |   |   |
| 601 | 95% Chebyshev (MVUE) UCL                                                                                                          |   |   | 0.256                                   | 97.5% Chebyshev (MVUE) UCL                     |   |   | 0.272   |   |   |   |
| 602 | 99% Chebyshev (MVUE) UCL                                                                                                          |   |   | 0.305                                   |                                                |   |   |         |   |   |   |
| 603 |                                                                                                                                   |   |   |                                         |                                                |   |   |         |   |   |   |

| A   | B                                                                                                                                        | C       | D | E                                           | F                                       | G | H | I      | J | K | L |  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---------|---|---------------------------------------------|-----------------------------------------|---|---|--------|---|---|---|--|
| 604 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 605 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 606 |                                                                                                                                          |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 607 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 608 | 95% CLT UCL                                                                                                                              | 0.231   |   | 95% Jackknife UCL                           | 0.242                                   |   |   |        |   |   |   |  |
| 609 | 95% Standard Bootstrap UCL                                                                                                               | N/A     |   | 95% Bootstrap-t UCL                         | N/A                                     |   |   |        |   |   |   |  |
| 610 | 95% Hall's Bootstrap UCL                                                                                                                 | N/A     |   | 95% Percentile Bootstrap UCL                | N/A                                     |   |   |        |   |   |   |  |
| 611 | 95% BCA Bootstrap UCL                                                                                                                    | N/A     |   |                                             |                                         |   |   |        |   |   |   |  |
| 612 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              | 0.243   |   | 95% Chebyshev(Mean, Sd) UCL                 | 0.255                                   |   |   |        |   |   |   |  |
| 613 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            | 0.272   |   | 99% Chebyshev(Mean, Sd) UCL                 | 0.304                                   |   |   |        |   |   |   |  |
| 614 |                                                                                                                                          |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 615 | <b>Suggested UCL to Use</b>                                                                                                              |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 616 | 95% Student's-t UCL                                                                                                                      | 0.242   |   |                                             |                                         |   |   |        |   |   |   |  |
| 617 |                                                                                                                                          |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 618 | <b>Recommended UCL exceeds the maximum observation</b>                                                                                   |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 619 |                                                                                                                                          |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 620 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 621 | Recommendations are based upon data size, data distribution, and skewness.                                                               |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 622 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 623 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 624 |                                                                                                                                          |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 625 | <b>Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be</b>                 |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 626 | <b>reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.</b>                                       |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 627 |                                                                                                                                          |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 628 | <b>Result (eu4_lead)</b>                                                                                                                 |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 629 |                                                                                                                                          |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 630 | <b>General Statistics</b>                                                                                                                |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 631 | Total Number of Observations                                                                                                             | 3       |   | Number of Distinct Observations             | 2                                       |   |   |        |   |   |   |  |
| 632 | Number of Detects                                                                                                                        | 0       |   | Number of Non-Detects                       | 3                                       |   |   |        |   |   |   |  |
| 633 | Number of Distinct Detects                                                                                                               | 0       |   | Number of Distinct Non-Detects              | 2                                       |   |   |        |   |   |   |  |
| 634 |                                                                                                                                          |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 635 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                       |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 636 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>                 |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 637 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>        |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 638 |                                                                                                                                          |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 639 | <b>The data set for variable Result (eu4_lead) was not processed!</b>                                                                    |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 640 |                                                                                                                                          |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 641 |                                                                                                                                          |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 642 |                                                                                                                                          |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 643 | <b>Result (eu4_manganese)</b>                                                                                                            |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 644 |                                                                                                                                          |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 645 | <b>General Statistics</b>                                                                                                                |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 646 | Total Number of Observations                                                                                                             | 3       |   | Number of Distinct Observations             | 3                                       |   |   |        |   |   |   |  |
| 647 |                                                                                                                                          |         |   | Number of Missing Observations              | 0                                       |   |   |        |   |   |   |  |
| 648 | Minimum                                                                                                                                  | 0.032   |   | Mean                                        | 0.0417                                  |   |   |        |   |   |   |  |
| 649 | Maximum                                                                                                                                  | 0.047   |   | Median                                      | 0.046                                   |   |   |        |   |   |   |  |
| 650 | SD                                                                                                                                       | 0.00839 |   | Std. Error of Mean                          | 0.00484                                 |   |   |        |   |   |   |  |
| 651 | Coefficient of Variation                                                                                                                 | 0.201   |   | Skewness                                    | -1.704                                  |   |   |        |   |   |   |  |
| 652 |                                                                                                                                          |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 653 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 654 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 655 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 656 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 657 |                                                                                                                                          |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 658 | <b>Normal GOF Test</b>                                                                                                                   |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 659 | Shapiro Wilk Test Statistic                                                                                                              | 0.8     |   | <b>Shapiro Wilk GOF Test</b>                |                                         |   |   |        |   |   |   |  |
| 660 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.767   |   | Data appear Normal at 5% Significance Level |                                         |   |   |        |   |   |   |  |
| 661 | Lilliefors Test Statistic                                                                                                                | 0.364   |   | <b>Lilliefors GOF Test</b>                  |                                         |   |   |        |   |   |   |  |
| 662 | 5% Lilliefors Critical Value                                                                                                             | 0.425   |   | Data appear Normal at 5% Significance Level |                                         |   |   |        |   |   |   |  |
| 663 | <b>Data appear Normal at 5% Significance Level</b>                                                                                       |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 664 |                                                                                                                                          |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 665 | <b>Assuming Normal Distribution</b>                                                                                                      |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 666 | <b>95% Normal UCL</b>                                                                                                                    |         |   |                                             | <b>95% UCLs (Adjusted for Skewness)</b> |   |   |        |   |   |   |  |
| 667 | 95% Student's-t UCL                                                                                                                      | 0.0558  |   | 95% Adjusted-CLT UCL (Chen-1995)            |                                         |   |   | 0.0445 |   |   |   |  |
| 668 |                                                                                                                                          |         |   | 95% Modified-t UCL (Johnson-1978)           |                                         |   |   | 0.055  |   |   |   |  |
| 669 |                                                                                                                                          |         |   |                                             |                                         |   |   |        |   |   |   |  |
| 670 | <b>Gamma GOF Test</b>                                                                                                                    |         |   |                                             |                                         |   |   |        |   |   |   |  |

|     | A                                                                                                                                        | B                              | C       | D                                      | E   | F                                              | G      | H | I | J | K | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|---------|----------------------------------------|-----|------------------------------------------------|--------|---|---|---|---|---|
| 671 | <b>Not Enough Data to Perform GOF Test</b>                                                                                               |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 672 |                                                                                                                                          |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 673 | <b>Gamma Statistics</b>                                                                                                                  |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 674 |                                                                                                                                          | k hat (MLE)                    | 33.81   |                                        |     | k star (bias corrected MLE)                    | N/A    |   |   |   |   |   |
| 675 |                                                                                                                                          | Theta hat (MLE)                | 0.00123 |                                        |     | Theta star (bias corrected MLE)                | N/A    |   |   |   |   |   |
| 676 |                                                                                                                                          | nu hat (MLE)                   | 202.9   |                                        |     | nu star (bias corrected)                       | N/A    |   |   |   |   |   |
| 677 |                                                                                                                                          | MLE Mean (bias corrected)      | N/A     |                                        |     | MLE Sd (bias corrected)                        | N/A    |   |   |   |   |   |
| 678 |                                                                                                                                          |                                |         |                                        |     | Approximate Chi Square Value (0.05)            | N/A    |   |   |   |   |   |
| 679 |                                                                                                                                          | Adjusted Level of Significance | N/A     |                                        |     | Adjusted Chi Square Value                      | N/A    |   |   |   |   |   |
| 680 |                                                                                                                                          |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 681 | <b>Assuming Gamma Distribution</b>                                                                                                       |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 682 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | N/A                            |         | 95% Adjusted Gamma UCL (use when n<50) | N/A |                                                |        |   |   |   |   |   |
| 683 |                                                                                                                                          |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 684 | <b>Lognormal GOF Test</b>                                                                                                                |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 685 |                                                                                                                                          | Shapiro Wilk Test Statistic    | 0.792   |                                        |     | <b>Shapiro Wilk Lognormal GOF Test</b>         |        |   |   |   |   |   |
| 686 |                                                                                                                                          | 5% Shapiro Wilk Critical Value | 0.767   |                                        |     | Data appear Lognormal at 5% Significance Level |        |   |   |   |   |   |
| 687 |                                                                                                                                          | Lilliefors Test Statistic      | 0.368   |                                        |     | <b>Lilliefors Lognormal GOF Test</b>           |        |   |   |   |   |   |
| 688 |                                                                                                                                          | 5% Lilliefors Critical Value   | 0.425   |                                        |     | Data appear Lognormal at 5% Significance Level |        |   |   |   |   |   |
| 689 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 690 |                                                                                                                                          |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 691 | <b>Lognormal Statistics</b>                                                                                                              |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 692 |                                                                                                                                          | Minimum of Logged Data         | -3.442  |                                        |     | Mean of logged Data                            | -3.193 |   |   |   |   |   |
| 693 |                                                                                                                                          | Maximum of Logged Data         | -3.058  |                                        |     | SD of logged Data                              | 0.216  |   |   |   |   |   |
| 694 |                                                                                                                                          |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 695 | <b>Assuming Lognormal Distribution</b>                                                                                                   |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 696 |                                                                                                                                          | 95% H-UCL                      | 0.0707  |                                        |     | 90% Chebyshev (MVUE) UCL                       | 0.0572 |   |   |   |   |   |
| 697 |                                                                                                                                          | 95% Chebyshev (MVUE) UCL       | 0.0642  |                                        |     | 97.5% Chebyshev (MVUE) UCL                     | 0.074  |   |   |   |   |   |
| 698 |                                                                                                                                          | 99% Chebyshev (MVUE) UCL       | 0.0931  |                                        |     |                                                |        |   |   |   |   |   |
| 699 |                                                                                                                                          |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 700 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 701 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 702 |                                                                                                                                          |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 703 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 704 |                                                                                                                                          | 95% CLT UCL                    | 0.0496  |                                        |     | 95% Jackknife UCL                              | 0.0558 |   |   |   |   |   |
| 705 |                                                                                                                                          | 95% Standard Bootstrap UCL     | N/A     |                                        |     | 95% Bootstrap-t UCL                            | N/A    |   |   |   |   |   |
| 706 |                                                                                                                                          | 95% Hall's Bootstrap UCL       | N/A     |                                        |     | 95% Percentile Bootstrap UCL                   | N/A    |   |   |   |   |   |
| 707 |                                                                                                                                          | 95% BCA Bootstrap UCL          | N/A     |                                        |     |                                                |        |   |   |   |   |   |
| 708 |                                                                                                                                          | 90% Chebyshev(Mean, Sd) UCL    | 0.0562  |                                        |     | 95% Chebyshev(Mean, Sd) UCL                    | 0.0628 |   |   |   |   |   |
| 709 |                                                                                                                                          | 97.5% Chebyshev(Mean, Sd) UCL  | 0.0719  |                                        |     | 99% Chebyshev(Mean, Sd) UCL                    | 0.0898 |   |   |   |   |   |
| 710 |                                                                                                                                          |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 711 | <b>Suggested UCL to Use</b>                                                                                                              |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 712 |                                                                                                                                          | 95% Student's-t UCL            | 0.0558  |                                        |     |                                                |        |   |   |   |   |   |
| 713 |                                                                                                                                          |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 714 | <b>Recommended UCL exceeds the maximum observation</b>                                                                                   |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 715 |                                                                                                                                          |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 716 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 717 | Recommendations are based upon data size, data distribution, and skewness.                                                               |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 718 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 719 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 720 |                                                                                                                                          |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 721 | <b>Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be</b>                 |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 722 | <b>reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.</b>                                       |                                |         |                                        |     |                                                |        |   |   |   |   |   |
| 723 |                                                                                                                                          |                                |         |                                        |     |                                                |        |   |   |   |   |   |

| A  | B                                                          | C                                | D     | E | F | G                                       | H     | I                                                   | J                  | K     | L |  |
|----|------------------------------------------------------------|----------------------------------|-------|---|---|-----------------------------------------|-------|-----------------------------------------------------|--------------------|-------|---|--|
| 1  | <b>UCL Statistics for Data Sets with Non-Detects</b>       |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 2  |                                                            |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 3  | User Selected Options                                      |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 4  | Date/Time of Computation                                   | ProUCL 5.12/8/2019 4:22:18 PM    |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 5  | From File                                                  | BPMD_HHRA_ATVGuide_SoilInput.xls |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 6  | Full Precision                                             | OFF                              |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 7  | Confidence Coefficient                                     | 95%                              |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 8  | Number of Bootstrap Operations                             | 2000                             |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 9  |                                                            |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 10 |                                                            |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 11 | <b>Result (eua_antimony_soil-road)</b>                     |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 12 |                                                            |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 13 | <b>General Statistics</b>                                  |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 14 | Total Number of Observations                               | 36                               |       |   |   |                                         |       | Number of Distinct Observations                     | 33                 |       |   |  |
| 15 |                                                            |                                  |       |   |   |                                         |       | Number of Missing Observations                      | 0                  |       |   |  |
| 16 |                                                            | Minimum                          | 0.35  |   |   |                                         |       |                                                     | Mean               | 1.344 |   |  |
| 17 |                                                            | Maximum                          | 6.02  |   |   |                                         |       |                                                     | Median             | 0.68  |   |  |
| 18 |                                                            | SD                               | 1.516 |   |   |                                         |       |                                                     | Std. Error of Mean | 0.253 |   |  |
| 19 |                                                            | Coefficient of Variation         | 1.128 |   |   |                                         |       |                                                     | Skewness           | 2.19  |   |  |
| 20 |                                                            |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 21 | <b>Normal GOF Test</b>                                     |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 22 | Shapiro Wilk Test Statistic                                | 0.652                            |       |   |   |                                         |       | <b>Shapiro Wilk GOF Test</b>                        |                    |       |   |  |
| 23 | 5% Shapiro Wilk Critical Value                             | 0.935                            |       |   |   |                                         |       | Data Not Normal at 5% Significance Level            |                    |       |   |  |
| 24 | Lilliefors Test Statistic                                  | 0.286                            |       |   |   |                                         |       | <b>Lilliefors GOF Test</b>                          |                    |       |   |  |
| 25 | 5% Lilliefors Critical Value                               | 0.145                            |       |   |   |                                         |       | Data Not Normal at 5% Significance Level            |                    |       |   |  |
| 26 | <b>Data Not Normal at 5% Significance Level</b>            |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 27 |                                                            |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 28 | <b>Assuming Normal Distribution</b>                        |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 29 | <b>95% Normal UCL</b>                                      |                                  |       |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |       |                                                     |                    |       |   |  |
| 30 | 95% Student's-t UCL                                        | 1.771                            |       |   |   | 95% Adjusted-CLT UCL (Chen-1995)        | 1.858 |                                                     |                    |       |   |  |
| 31 |                                                            |                                  |       |   |   | 95% Modified-t UCL (Johnson-1978)       | 1.786 |                                                     |                    |       |   |  |
| 32 |                                                            |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 33 | <b>Gamma GOF Test</b>                                      |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 34 | A-D Test Statistic                                         | 2.378                            |       |   |   |                                         |       | <b>Anderson-Darling Gamma GOF Test</b>              |                    |       |   |  |
| 35 | 5% A-D Critical Value                                      | 0.769                            |       |   |   |                                         |       | Data Not Gamma Distributed at 5% Significance Level |                    |       |   |  |
| 36 | K-S Test Statistic                                         | 0.202                            |       |   |   |                                         |       | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |                    |       |   |  |
| 37 | 5% K-S Critical Value                                      | 0.15                             |       |   |   |                                         |       | Data Not Gamma Distributed at 5% Significance Level |                    |       |   |  |
| 38 | <b>Data Not Gamma Distributed at 5% Significance Level</b> |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 39 |                                                            |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 40 | <b>Gamma Statistics</b>                                    |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 41 | k hat (MLE)                                                | 1.379                            |       |   |   |                                         |       | k star (bias corrected MLE)                         | 1.283              |       |   |  |
| 42 | Theta hat (MLE)                                            | 0.974                            |       |   |   |                                         |       | Theta star (bias corrected MLE)                     | 1.048              |       |   |  |
| 43 | nu hat (MLE)                                               | 99.31                            |       |   |   |                                         |       | nu star (bias corrected)                            | 92.37              |       |   |  |
| 44 | MLE Mean (bias corrected)                                  | 1.344                            |       |   |   |                                         |       | MLE Sd (bias corrected)                             | 1.187              |       |   |  |
| 45 |                                                            |                                  |       |   |   |                                         |       | Approximate Chi Square Value (0.05)                 | 71.21              |       |   |  |
| 46 | Adjusted Level of Significance                             | 0.0428                           |       |   |   |                                         |       | Adjusted Chi Square Value                           | 70.36              |       |   |  |
| 47 |                                                            |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 48 | <b>Assuming Gamma Distribution</b>                         |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 49 | 95% Approximate Gamma UCL (use when n>=50))                | 1.744                            |       |   |   |                                         |       | 95% Adjusted Gamma UCL (use when n<50)              | 1.764              |       |   |  |
| 50 |                                                            |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 51 | <b>Lognormal GOF Test</b>                                  |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 52 | Shapiro Wilk Test Statistic                                | 0.878                            |       |   |   |                                         |       | <b>Shapiro Wilk Lognormal GOF Test</b>              |                    |       |   |  |
| 53 | 5% Shapiro Wilk Critical Value                             | 0.935                            |       |   |   |                                         |       | Data Not Lognormal at 5% Significance Level         |                    |       |   |  |
| 54 | Lilliefors Test Statistic                                  | 0.155                            |       |   |   |                                         |       | <b>Lilliefors Lognormal GOF Test</b>                |                    |       |   |  |
| 55 | 5% Lilliefors Critical Value                               | 0.145                            |       |   |   |                                         |       | Data Not Lognormal at 5% Significance Level         |                    |       |   |  |
| 56 | <b>Data Not Lognormal at 5% Significance Level</b>         |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 57 |                                                            |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 58 | <b>Lognormal Statistics</b>                                |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 59 | Minimum of Logged Data                                     | -1.05                            |       |   |   |                                         |       | Mean of logged Data                                 | -0.109             |       |   |  |
| 60 | Maximum of Logged Data                                     | 1.795                            |       |   |   |                                         |       | SD of logged Data                                   | 0.831              |       |   |  |
| 61 |                                                            |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 62 | <b>Assuming Lognormal Distribution</b>                     |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 63 | 95% H-UCL                                                  | 1.726                            |       |   |   |                                         |       | 90% Chebyshev (MVUE) UCL                            | 1.832              |       |   |  |
| 64 | 95% Chebyshev (MVUE) UCL                                   | 2.095                            |       |   |   |                                         |       | 97.5% Chebyshev (MVUE) UCL                          | 2.46               |       |   |  |
| 65 | 99% Chebyshev (MVUE) UCL                                   | 3.177                            |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 66 |                                                            |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |
| 67 | <b>Nonparametric Distribution Free UCL Statistics</b>      |                                  |       |   |   |                                         |       |                                                     |                    |       |   |  |

| A   | B                                                                                                                                         | C      | E                                                               | F     | G                                       | H | I | J | K | L |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------------------|-------|-----------------------------------------|---|---|---|---|---|
| 68  | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                               |        |                                                                 |       |                                         |   |   |   |   |   |
| 69  |                                                                                                                                           |        |                                                                 |       |                                         |   |   |   |   |   |
| 70  | <b>Nonparametric Distribution Free UCLs</b>                                                                                               |        |                                                                 |       |                                         |   |   |   |   |   |
| 71  | 95% CLT UCL                                                                                                                               | 1.76   | 95% Jackknife UCL                                               | 1.771 |                                         |   |   |   |   |   |
| 72  | 95% Standard Bootstrap UCL                                                                                                                | 1.754  | 95% Bootstrap-t UCL                                             | 1.938 |                                         |   |   |   |   |   |
| 73  | 95% Hall's Bootstrap UCL                                                                                                                  | 1.8    | 95% Percentile Bootstrap UCL                                    | 1.781 |                                         |   |   |   |   |   |
| 74  | 95% BCA Bootstrap UCL                                                                                                                     | 1.881  |                                                                 |       |                                         |   |   |   |   |   |
| 75  | 90% Chebyshev(Mean, Sd) UCL                                                                                                               | 2.102  | 95% Chebyshev(Mean, Sd) UCL                                     | 2.445 |                                         |   |   |   |   |   |
| 76  | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                             | 2.922  | 99% Chebyshev(Mean, Sd) UCL                                     | 3.858 |                                         |   |   |   |   |   |
| 77  |                                                                                                                                           |        |                                                                 |       |                                         |   |   |   |   |   |
| 78  | <b>Suggested UCL to Use</b>                                                                                                               |        |                                                                 |       |                                         |   |   |   |   |   |
| 79  | 95% Chebyshev (Mean, Sd) UCL                                                                                                              | 2.445  |                                                                 |       |                                         |   |   |   |   |   |
| 80  |                                                                                                                                           |        |                                                                 |       |                                         |   |   |   |   |   |
| 81  | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |        |                                                                 |       |                                         |   |   |   |   |   |
| 82  | Recommendations are based upon data size, data distribution, and skewness.                                                                |        |                                                                 |       |                                         |   |   |   |   |   |
| 83  | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |        |                                                                 |       |                                         |   |   |   |   |   |
| 84  | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |        |                                                                 |       |                                         |   |   |   |   |   |
| 85  |                                                                                                                                           |        |                                                                 |       |                                         |   |   |   |   |   |
| 86  |                                                                                                                                           |        |                                                                 |       |                                         |   |   |   |   |   |
| 87  | <b>Result (eua_arsenic_soil-road)</b>                                                                                                     |        |                                                                 |       |                                         |   |   |   |   |   |
| 88  |                                                                                                                                           |        |                                                                 |       |                                         |   |   |   |   |   |
| 89  | <b>General Statistics</b>                                                                                                                 |        |                                                                 |       |                                         |   |   |   |   |   |
| 90  | Total Number of Observations                                                                                                              | 36     | Number of Distinct Observations                                 | 35    |                                         |   |   |   |   |   |
| 91  |                                                                                                                                           |        | Number of Missing Observations                                  | 0     |                                         |   |   |   |   |   |
| 92  | Minimum                                                                                                                                   | 3.19   | Mean                                                            | 19.95 |                                         |   |   |   |   |   |
| 93  | Maximum                                                                                                                                   | 106    | Median                                                          | 19.3  |                                         |   |   |   |   |   |
| 94  | SD                                                                                                                                        | 17.25  | Std. Error of Mean                                              | 2.874 |                                         |   |   |   |   |   |
| 95  | Coefficient of Variation                                                                                                                  | 0.864  | Skewness                                                        | 3.65  |                                         |   |   |   |   |   |
| 96  |                                                                                                                                           |        |                                                                 |       |                                         |   |   |   |   |   |
| 97  | <b>Normal GOF Test</b>                                                                                                                    |        |                                                                 |       |                                         |   |   |   |   |   |
| 98  | Shapiro Wilk Test Statistic                                                                                                               | 0.659  | <b>Shapiro Wilk GOF Test</b>                                    |       |                                         |   |   |   |   |   |
| 99  | 5% Shapiro Wilk Critical Value                                                                                                            | 0.935  | Data Not Normal at 5% Significance Level                        |       |                                         |   |   |   |   |   |
| 100 | Lilliefors Test Statistic                                                                                                                 | 0.209  | <b>Lilliefors GOF Test</b>                                      |       |                                         |   |   |   |   |   |
| 101 | 5% Lilliefors Critical Value                                                                                                              | 0.145  | Data Not Normal at 5% Significance Level                        |       |                                         |   |   |   |   |   |
| 102 | <b>Data Not Normal at 5% Significance Level</b>                                                                                           |        |                                                                 |       |                                         |   |   |   |   |   |
| 103 |                                                                                                                                           |        |                                                                 |       |                                         |   |   |   |   |   |
| 104 | <b>Assuming Normal Distribution</b>                                                                                                       |        |                                                                 |       |                                         |   |   |   |   |   |
| 105 | <b>95% Normal UCL</b>                                                                                                                     |        |                                                                 |       | <b>95% UCLs (Adjusted for Skewness)</b> |   |   |   |   |   |
| 106 | 95% Student's-t UCL                                                                                                                       | 24.81  | 95% Adjusted-CLT UCL (Chen-1995)                                | 26.55 |                                         |   |   |   |   |   |
| 107 |                                                                                                                                           |        | 95% Modified-t UCL (Johnson-1978)                               | 25.1  |                                         |   |   |   |   |   |
| 108 |                                                                                                                                           |        |                                                                 |       |                                         |   |   |   |   |   |
| 109 | <b>Gamma GOF Test</b>                                                                                                                     |        |                                                                 |       |                                         |   |   |   |   |   |
| 110 | A-D Test Statistic                                                                                                                        | 0.646  | <b>Anderson-Darling Gamma GOF Test</b>                          |       |                                         |   |   |   |   |   |
| 111 | 5% A-D Critical Value                                                                                                                     | 0.759  | Detected data appear Gamma Distributed at 5% Significance Level |       |                                         |   |   |   |   |   |
| 112 | K-S Test Statistic                                                                                                                        | 0.126  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |       |                                         |   |   |   |   |   |
| 113 | 5% K-S Critical Value                                                                                                                     | 0.149  | Detected data appear Gamma Distributed at 5% Significance Level |       |                                         |   |   |   |   |   |
| 114 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                    |        |                                                                 |       |                                         |   |   |   |   |   |
| 115 |                                                                                                                                           |        |                                                                 |       |                                         |   |   |   |   |   |
| 116 | <b>Gamma Statistics</b>                                                                                                                   |        |                                                                 |       |                                         |   |   |   |   |   |
| 117 | k hat (MLE)                                                                                                                               | 2.172  | k star (bias corrected MLE)                                     | 2.009 |                                         |   |   |   |   |   |
| 118 | Theta hat (MLE)                                                                                                                           | 9.187  | Theta star (bias corrected MLE)                                 | 9.93  |                                         |   |   |   |   |   |
| 119 | nu hat (MLE)                                                                                                                              | 156.4  | nu star (bias corrected)                                        | 144.7 |                                         |   |   |   |   |   |
| 120 | MLE Mean (bias corrected)                                                                                                                 | 19.95  | MLE Sd (bias corrected)                                         | 14.08 |                                         |   |   |   |   |   |
| 121 |                                                                                                                                           |        | Approximate Chi Square Value (0.05)                             | 117.9 |                                         |   |   |   |   |   |
| 122 | Adjusted Level of Significance                                                                                                            | 0.0428 | Adjusted Chi Square Value                                       | 116.8 |                                         |   |   |   |   |   |
| 123 |                                                                                                                                           |        |                                                                 |       |                                         |   |   |   |   |   |
| 124 | <b>Assuming Gamma Distribution</b>                                                                                                        |        |                                                                 |       |                                         |   |   |   |   |   |
| 125 | 95% Approximate Gamma UCL (use when n>=50)                                                                                                | 24.49  | 95% Adjusted Gamma UCL (use when n<50)                          | 24.72 |                                         |   |   |   |   |   |
| 126 |                                                                                                                                           |        |                                                                 |       |                                         |   |   |   |   |   |
| 127 | <b>Lognormal GOF Test</b>                                                                                                                 |        |                                                                 |       |                                         |   |   |   |   |   |
| 128 | Shapiro Wilk Test Statistic                                                                                                               | 0.956  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |       |                                         |   |   |   |   |   |
| 129 | 5% Shapiro Wilk Critical Value                                                                                                            | 0.935  | Data appear Lognormal at 5% Significance Level                  |       |                                         |   |   |   |   |   |
| 130 | Lilliefors Test Statistic                                                                                                                 | 0.156  | <b>Lilliefors Lognormal GOF Test</b>                            |       |                                         |   |   |   |   |   |
| 131 | 5% Lilliefors Critical Value                                                                                                              | 0.145  | Data Not Lognormal at 5% Significance Level                     |       |                                         |   |   |   |   |   |
| 132 | <b>Data appear Approximate Lognormal at 5% Significance Level</b>                                                                         |        |                                                                 |       |                                         |   |   |   |   |   |
| 133 |                                                                                                                                           |        |                                                                 |       |                                         |   |   |   |   |   |
| 134 | <b>Lognormal Statistics</b>                                                                                                               |        |                                                                 |       |                                         |   |   |   |   |   |

| A   | B                                                                                                                                         | C | D | E | F      | G                                                               | H | I | J | K     | L |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|--------|-----------------------------------------------------------------|---|---|---|-------|---|
| 135 | Minimum of Logged Data                                                                                                                    |   |   |   | 1.16   | Mean of logged Data                                             |   |   |   | 2.746 |   |
| 136 | Maximum of Logged Data                                                                                                                    |   |   |   | 4.663  | SD of logged Data                                               |   |   |   | 0.716 |   |
| 137 |                                                                                                                                           |   |   |   |        |                                                                 |   |   |   |       |   |
| 138 | <b>Assuming Lognormal Distribution</b>                                                                                                    |   |   |   |        |                                                                 |   |   |   |       |   |
| 139 | 95% H-UCL                                                                                                                                 |   |   |   | 25.92  | 90% Chebyshev (MVUE) UCL                                        |   |   |   | 27.74 |   |
| 140 | 95% Chebyshev (MVUE) UCL                                                                                                                  |   |   |   | 31.27  | 97.5% Chebyshev (MVUE) UCL                                      |   |   |   | 36.16 |   |
| 141 | 99% Chebyshev (MVUE) UCL                                                                                                                  |   |   |   | 45.78  |                                                                 |   |   |   |       |   |
| 142 |                                                                                                                                           |   |   |   |        |                                                                 |   |   |   |       |   |
| 143 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                     |   |   |   |        |                                                                 |   |   |   |       |   |
| 144 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                          |   |   |   |        |                                                                 |   |   |   |       |   |
| 145 |                                                                                                                                           |   |   |   |        |                                                                 |   |   |   |       |   |
| 146 | <b>Nonparametric Distribution Free UCLs</b>                                                                                               |   |   |   |        |                                                                 |   |   |   |       |   |
| 147 | 95% CLT UCL                                                                                                                               |   |   |   | 24.68  | 95% Jackknife UCL                                               |   |   |   | 24.81 |   |
| 148 | 95% Standard Bootstrap UCL                                                                                                                |   |   |   | 24.63  | 95% Bootstrap-t UCL                                             |   |   |   | 27.98 |   |
| 149 | 95% Hall's Bootstrap UCL                                                                                                                  |   |   |   | 46.73  | 95% Percentile Bootstrap UCL                                    |   |   |   | 25.34 |   |
| 150 | 95% BCA Bootstrap UCL                                                                                                                     |   |   |   | 27     |                                                                 |   |   |   |       |   |
| 151 | 90% Chebyshev(Mean, Sd) UCL                                                                                                               |   |   |   | 28.58  | 95% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 32.48 |   |
| 152 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                             |   |   |   | 37.9   | 99% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 48.55 |   |
| 153 |                                                                                                                                           |   |   |   |        |                                                                 |   |   |   |       |   |
| 154 | <b>Suggested UCL to Use</b>                                                                                                               |   |   |   |        |                                                                 |   |   |   |       |   |
| 155 | 95% Adjusted Gamma UCL                                                                                                                    |   |   |   | 24.72  |                                                                 |   |   |   |       |   |
| 156 |                                                                                                                                           |   |   |   |        |                                                                 |   |   |   |       |   |
| 157 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |   |   |   |        |                                                                 |   |   |   |       |   |
| 158 | Recommendations are based upon data size, data distribution, and skewness.                                                                |   |   |   |        |                                                                 |   |   |   |       |   |
| 159 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |   |   |   |        |                                                                 |   |   |   |       |   |
| 160 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |   |   |   |        |                                                                 |   |   |   |       |   |
| 161 |                                                                                                                                           |   |   |   |        |                                                                 |   |   |   |       |   |
| 162 |                                                                                                                                           |   |   |   |        |                                                                 |   |   |   |       |   |
| 163 | <b>Result (eua_cadmium_soil-road)</b>                                                                                                     |   |   |   |        |                                                                 |   |   |   |       |   |
| 164 |                                                                                                                                           |   |   |   |        |                                                                 |   |   |   |       |   |
| 165 | <b>General Statistics</b>                                                                                                                 |   |   |   |        |                                                                 |   |   |   |       |   |
| 166 | Total Number of Observations                                                                                                              |   |   |   | 36     | Number of Distinct Observations                                 |   |   |   | 31    |   |
| 167 |                                                                                                                                           |   |   |   |        | Number of Missing Observations                                  |   |   |   | 0     |   |
| 168 | Minimum                                                                                                                                   |   |   |   | 0.291  | Mean                                                            |   |   |   | 1.48  |   |
| 169 | Maximum                                                                                                                                   |   |   |   | 6.06   | Median                                                          |   |   |   | 1.025 |   |
| 170 | SD                                                                                                                                        |   |   |   | 1.269  | Std. Error of Mean                                              |   |   |   | 0.212 |   |
| 171 | Coefficient of Variation                                                                                                                  |   |   |   | 0.858  | Skewness                                                        |   |   |   | 2.321 |   |
| 172 |                                                                                                                                           |   |   |   |        |                                                                 |   |   |   |       |   |
| 173 | <b>Normal GOF Test</b>                                                                                                                    |   |   |   |        |                                                                 |   |   |   |       |   |
| 174 | Shapiro Wilk Test Statistic                                                                                                               |   |   |   | 0.743  | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |       |   |
| 175 | 5% Shapiro Wilk Critical Value                                                                                                            |   |   |   | 0.935  | Data Not Normal at 5% Significance Level                        |   |   |   |       |   |
| 176 | Lilliefors Test Statistic                                                                                                                 |   |   |   | 0.195  | <b>Lilliefors GOF Test</b>                                      |   |   |   |       |   |
| 177 | 5% Lilliefors Critical Value                                                                                                              |   |   |   | 0.145  | Data Not Normal at 5% Significance Level                        |   |   |   |       |   |
| 178 | <b>Data Not Normal at 5% Significance Level</b>                                                                                           |   |   |   |        |                                                                 |   |   |   |       |   |
| 179 |                                                                                                                                           |   |   |   |        |                                                                 |   |   |   |       |   |
| 180 | <b>Assuming Normal Distribution</b>                                                                                                       |   |   |   |        |                                                                 |   |   |   |       |   |
| 181 | <b>95% Normal UCL</b>                                                                                                                     |   |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |   |       |   |
| 182 | 95% Student's-t UCL                                                                                                                       |   |   |   | 1.837  | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |   | 1.915 |   |
| 183 |                                                                                                                                           |   |   |   |        | 95% Modified-t UCL (Johnson-1978)                               |   |   |   | 1.851 |   |
| 184 |                                                                                                                                           |   |   |   |        |                                                                 |   |   |   |       |   |
| 185 | <b>Gamma GOF Test</b>                                                                                                                     |   |   |   |        |                                                                 |   |   |   |       |   |
| 186 | A-D Test Statistic                                                                                                                        |   |   |   | 0.696  | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |   |       |   |
| 187 | 5% A-D Critical Value                                                                                                                     |   |   |   | 0.759  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |       |   |
| 188 | K-S Test Statistic                                                                                                                        |   |   |   | 0.116  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |   |       |   |
| 189 | 5% K-S Critical Value                                                                                                                     |   |   |   | 0.149  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |       |   |
| 190 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                    |   |   |   |        |                                                                 |   |   |   |       |   |
| 191 |                                                                                                                                           |   |   |   |        |                                                                 |   |   |   |       |   |
| 192 | <b>Gamma Statistics</b>                                                                                                                   |   |   |   |        |                                                                 |   |   |   |       |   |
| 193 | k hat (MLE)                                                                                                                               |   |   |   | 2.041  | k star (bias corrected MLE)                                     |   |   |   | 1.889 |   |
| 194 | Theta hat (MLE)                                                                                                                           |   |   |   | 0.725  | Theta star (bias corrected MLE)                                 |   |   |   | 0.783 |   |
| 195 | nu hat (MLE)                                                                                                                              |   |   |   | 146.9  | nu star (bias corrected)                                        |   |   |   | 136   |   |
| 196 | MLE Mean (bias corrected)                                                                                                                 |   |   |   | 1.48   | MLE Sd (bias corrected)                                         |   |   |   | 1.077 |   |
| 197 |                                                                                                                                           |   |   |   |        | Approximate Chi Square Value (0.05)                             |   |   |   | 110.1 |   |
| 198 | Adjusted Level of Significance                                                                                                            |   |   |   | 0.0428 | Adjusted Chi Square Value                                       |   |   |   | 109   |   |
| 199 |                                                                                                                                           |   |   |   |        |                                                                 |   |   |   |       |   |
| 200 | <b>Assuming Gamma Distribution</b>                                                                                                        |   |   |   |        |                                                                 |   |   |   |       |   |
| 201 | 95% Approximate Gamma UCL (use when n>=50)                                                                                                |   |   |   | 1.828  | 95% Adjusted Gamma UCL (use when n<50)                          |   |   |   | 1.846 |   |

|     | A                                                                                                                                        | B | C      | D                                                               | E | F | G | H                                       | I | J     | K | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|-----------------------------------------------------------------|---|---|---|-----------------------------------------|---|-------|---|---|
| 202 |                                                                                                                                          |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 203 | <b>Lognormal GOF Test</b>                                                                                                                |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 204 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.975  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |   |                                         |   |       |   |   |
| 205 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.935  | Data appear Lognormal at 5% Significance Level                  |   |   |   |                                         |   |       |   |   |
| 206 | Lilliefors Test Statistic                                                                                                                |   | 0.0732 | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |   |                                         |   |       |   |   |
| 207 | 5% Lilliefors Critical Value                                                                                                             |   | 0.145  | Data appear Lognormal at 5% Significance Level                  |   |   |   |                                         |   |       |   |   |
| 208 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 209 |                                                                                                                                          |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 210 | <b>Lognormal Statistics</b>                                                                                                              |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 211 | Minimum of Logged Data                                                                                                                   |   | -1.234 |                                                                 |   |   |   | Mean of logged Data                     |   | 0.127 |   |   |
| 212 | Maximum of Logged Data                                                                                                                   |   | 1.802  |                                                                 |   |   |   | SD of logged Data                       |   | 0.716 |   |   |
| 213 |                                                                                                                                          |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 214 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 215 | 95% H-UCL                                                                                                                                |   | 1.891  |                                                                 |   |   |   | 90% Chebyshev (MVUE) UCL                |   | 2.024 |   |   |
| 216 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 2.281  |                                                                 |   |   |   | 97.5% Chebyshev (MVUE) UCL              |   | 2.638 |   |   |
| 217 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 3.34   |                                                                 |   |   |   |                                         |   |       |   |   |
| 218 |                                                                                                                                          |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 219 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 220 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 221 |                                                                                                                                          |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 222 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 223 | 95% CLT UCL                                                                                                                              |   | 1.828  |                                                                 |   |   |   | 95% Jackknife UCL                       |   | 1.837 |   |   |
| 224 | 95% Standard Bootstrap UCL                                                                                                               |   | 1.825  |                                                                 |   |   |   | 95% Bootstrap-t UCL                     |   | 2.063 |   |   |
| 225 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 2.235  |                                                                 |   |   |   | 95% Percentile Bootstrap UCL            |   | 1.842 |   |   |
| 226 | 95% BCA Bootstrap UCL                                                                                                                    |   | 1.954  |                                                                 |   |   |   |                                         |   |       |   |   |
| 227 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 2.114  |                                                                 |   |   |   | 95% Chebyshev(Mean, Sd) UCL             |   | 2.402 |   |   |
| 228 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 2.801  |                                                                 |   |   |   | 99% Chebyshev(Mean, Sd) UCL             |   | 3.585 |   |   |
| 229 |                                                                                                                                          |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 230 | <b>Suggested UCL to Use</b>                                                                                                              |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 231 | 95% Adjusted Gamma UCL                                                                                                                   |   | 1.846  |                                                                 |   |   |   |                                         |   |       |   |   |
| 232 |                                                                                                                                          |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 233 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 234 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 235 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 236 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 237 |                                                                                                                                          |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 238 |                                                                                                                                          |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 239 | <b>Result (eua_chromium_soil-road)</b>                                                                                                   |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 240 |                                                                                                                                          |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 241 | <b>General Statistics</b>                                                                                                                |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 242 | Total Number of Observations                                                                                                             |   | 36     |                                                                 |   |   |   | Number of Distinct Observations         |   | 29    |   |   |
| 243 |                                                                                                                                          |   |        |                                                                 |   |   |   | Number of Missing Observations          |   | 0     |   |   |
| 244 | Minimum                                                                                                                                  |   | 2.27   |                                                                 |   |   |   | Mean                                    |   | 4.925 |   |   |
| 245 | Maximum                                                                                                                                  |   | 8.4    |                                                                 |   |   |   | Median                                  |   | 5.03  |   |   |
| 246 | SD                                                                                                                                       |   | 1.435  |                                                                 |   |   |   | Std. Error of Mean                      |   | 0.239 |   |   |
| 247 | Coefficient of Variation                                                                                                                 |   | 0.291  |                                                                 |   |   |   | Skewness                                |   | 0.242 |   |   |
| 248 |                                                                                                                                          |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 249 | <b>Normal GOF Test</b>                                                                                                                   |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 250 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.981  | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |                                         |   |       |   |   |
| 251 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.935  | Data appear Normal at 5% Significance Level                     |   |   |   |                                         |   |       |   |   |
| 252 | Lilliefors Test Statistic                                                                                                                |   | 0.087  | <b>Lilliefors GOF Test</b>                                      |   |   |   |                                         |   |       |   |   |
| 253 | 5% Lilliefors Critical Value                                                                                                             |   | 0.145  | Data appear Normal at 5% Significance Level                     |   |   |   |                                         |   |       |   |   |
| 254 | <b>Data appear Normal at 5% Significance Level</b>                                                                                       |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 255 |                                                                                                                                          |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 256 | <b>Assuming Normal Distribution</b>                                                                                                      |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 257 | <b>95% Normal UCL</b>                                                                                                                    |   |        |                                                                 |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |       |   |   |
| 258 | 95% Student's-t UCL                                                                                                                      |   | 5.329  |                                                                 |   |   |   | 95% Adjusted-CLT UCL (Chen-1995)        |   | 5.328 |   |   |
| 259 |                                                                                                                                          |   |        |                                                                 |   |   |   | 95% Modified-t UCL (Johnson-1978)       |   | 5.33  |   |   |
| 260 |                                                                                                                                          |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 261 | <b>Gamma GOF Test</b>                                                                                                                    |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 262 | A-D Test Statistic                                                                                                                       |   | 0.224  | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |   |                                         |   |       |   |   |
| 263 | 5% A-D Critical Value                                                                                                                    |   | 0.748  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |                                         |   |       |   |   |
| 264 | K-S Test Statistic                                                                                                                       |   | 0.0861 | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |   |                                         |   |       |   |   |
| 265 | 5% K-S Critical Value                                                                                                                    |   | 0.147  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |                                         |   |       |   |   |
| 266 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 267 |                                                                                                                                          |   |        |                                                                 |   |   |   |                                         |   |       |   |   |
| 268 | <b>Gamma Statistics</b>                                                                                                                  |   |        |                                                                 |   |   |   |                                         |   |       |   |   |

|     |  |  |                                                                                                                                           |        |  |                                                |       |  |
|-----|--|--|-------------------------------------------------------------------------------------------------------------------------------------------|--------|--|------------------------------------------------|-------|--|
| 269 |  |  | k hat (MLE)                                                                                                                               | 11.53  |  | k star (bias corrected MLE)                    | 10.59 |  |
| 270 |  |  | Theta hat (MLE)                                                                                                                           | 0.427  |  | Theta star (bias corrected MLE)                | 0.465 |  |
| 271 |  |  | nu hat (MLE)                                                                                                                              | 830.2  |  | nu star (bias corrected)                       | 762.4 |  |
| 272 |  |  | MLE Mean (bias corrected)                                                                                                                 | 4.925  |  | MLE Sd (bias corrected)                        | 1.513 |  |
| 273 |  |  |                                                                                                                                           |        |  | Approximate Chi Square Value (0.05)            | 699.3 |  |
| 274 |  |  | Adjusted Level of Significance                                                                                                            | 0.0428 |  | Adjusted Chi Square Value                      | 696.6 |  |
| 275 |  |  |                                                                                                                                           |        |  |                                                |       |  |
| 276 |  |  | <b>Assuming Gamma Distribution</b>                                                                                                        |        |  |                                                |       |  |
| 277 |  |  | 95% Approximate Gamma UCL (use when n>=50))                                                                                               | 5.369  |  | 95% Adjusted Gamma UCL (use when n<50)         | 5.39  |  |
| 278 |  |  |                                                                                                                                           |        |  |                                                |       |  |
| 279 |  |  | <b>Lognormal GOF Test</b>                                                                                                                 |        |  |                                                |       |  |
| 280 |  |  | Shapiro Wilk Test Statistic                                                                                                               | 0.971  |  | <b>Shapiro Wilk Lognormal GOF Test</b>         |       |  |
| 281 |  |  | 5% Shapiro Wilk Critical Value                                                                                                            | 0.935  |  | Data appear Lognormal at 5% Significance Level |       |  |
| 282 |  |  | Lilliefors Test Statistic                                                                                                                 | 0.101  |  | <b>Lilliefors Lognormal GOF Test</b>           |       |  |
| 283 |  |  | 5% Lilliefors Critical Value                                                                                                              | 0.145  |  | Data appear Lognormal at 5% Significance Level |       |  |
| 284 |  |  | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                     |        |  |                                                |       |  |
| 285 |  |  |                                                                                                                                           |        |  |                                                |       |  |
| 286 |  |  | <b>Lognormal Statistics</b>                                                                                                               |        |  |                                                |       |  |
| 287 |  |  | Minimum of Logged Data                                                                                                                    | 0.82   |  | Mean of logged Data                            | 1.55  |  |
| 288 |  |  | Maximum of Logged Data                                                                                                                    | 2.128  |  | SD of logged Data                              | 0.308 |  |
| 289 |  |  |                                                                                                                                           |        |  |                                                |       |  |
| 290 |  |  | <b>Assuming Lognormal Distribution</b>                                                                                                    |        |  |                                                |       |  |
| 291 |  |  | 95% H-UCL                                                                                                                                 | 5.424  |  | 90% Chebyshev (MVUE) UCL                       | 5.709 |  |
| 292 |  |  | 95% Chebyshev (MVUE) UCL                                                                                                                  | 6.06   |  | 97.5% Chebyshev (MVUE) UCL                     | 6.546 |  |
| 293 |  |  | 99% Chebyshev (MVUE) UCL                                                                                                                  | 7.502  |  |                                                |       |  |
| 294 |  |  |                                                                                                                                           |        |  |                                                |       |  |
| 295 |  |  | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                     |        |  |                                                |       |  |
| 296 |  |  | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                          |        |  |                                                |       |  |
| 297 |  |  |                                                                                                                                           |        |  |                                                |       |  |
| 298 |  |  | <b>Nonparametric Distribution Free UCLs</b>                                                                                               |        |  |                                                |       |  |
| 299 |  |  | 95% CLT UCL                                                                                                                               | 5.318  |  | 95% Jackknife UCL                              | 5.329 |  |
| 300 |  |  | 95% Standard Bootstrap UCL                                                                                                                | 5.312  |  | 95% Bootstrap-t UCL                            | 5.32  |  |
| 301 |  |  | 95% Hall's Bootstrap UCL                                                                                                                  | 5.343  |  | 95% Percentile Bootstrap UCL                   | 5.31  |  |
| 302 |  |  | 95% BCA Bootstrap UCL                                                                                                                     | 5.298  |  |                                                |       |  |
| 303 |  |  | 90% Chebyshev(Mean, Sd) UCL                                                                                                               | 5.642  |  | 95% Chebyshev(Mean, Sd) UCL                    | 5.967 |  |
| 304 |  |  | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                             | 6.418  |  | 99% Chebyshev(Mean, Sd) UCL                    | 7.304 |  |
| 305 |  |  |                                                                                                                                           |        |  |                                                |       |  |
| 306 |  |  | <b>Suggested UCL to Use</b>                                                                                                               |        |  |                                                |       |  |
| 307 |  |  | 95% Student's-t UCL                                                                                                                       | 5.329  |  |                                                |       |  |
| 308 |  |  |                                                                                                                                           |        |  |                                                |       |  |
| 309 |  |  | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |        |  |                                                |       |  |
| 310 |  |  | Recommendations are based upon data size, data distribution, and skewness.                                                                |        |  |                                                |       |  |
| 311 |  |  | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |        |  |                                                |       |  |
| 312 |  |  | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |        |  |                                                |       |  |
| 313 |  |  |                                                                                                                                           |        |  |                                                |       |  |
| 314 |  |  |                                                                                                                                           |        |  |                                                |       |  |
| 315 |  |  | <b>Result (eua_cobalt_soil-road)</b>                                                                                                      |        |  |                                                |       |  |
| 316 |  |  |                                                                                                                                           |        |  |                                                |       |  |
| 317 |  |  | <b>General Statistics</b>                                                                                                                 |        |  |                                                |       |  |
| 318 |  |  | Total Number of Observations                                                                                                              | 36     |  | Number of Distinct Observations                | 27    |  |
| 319 |  |  |                                                                                                                                           |        |  | Number of Missing Observations                 | 0     |  |
| 320 |  |  | Minimum                                                                                                                                   | 2.98   |  | Mean                                           | 6.087 |  |
| 321 |  |  | Maximum                                                                                                                                   | 11.7   |  | Median                                         | 6.1   |  |
| 322 |  |  | SD                                                                                                                                        | 1.623  |  | Std. Error of Mean                             | 0.271 |  |
| 323 |  |  | Coefficient of Variation                                                                                                                  | 0.267  |  | Skewness                                       | 1.036 |  |
| 324 |  |  |                                                                                                                                           |        |  |                                                |       |  |
| 325 |  |  | <b>Normal GOF Test</b>                                                                                                                    |        |  |                                                |       |  |
| 326 |  |  | Shapiro Wilk Test Statistic                                                                                                               | 0.936  |  | <b>Shapiro Wilk GOF Test</b>                   |       |  |
| 327 |  |  | 5% Shapiro Wilk Critical Value                                                                                                            | 0.935  |  | Data appear Normal at 5% Significance Level    |       |  |
| 328 |  |  | Lilliefors Test Statistic                                                                                                                 | 0.127  |  | <b>Lilliefors GOF Test</b>                     |       |  |
| 329 |  |  | 5% Lilliefors Critical Value                                                                                                              | 0.145  |  | Data appear Normal at 5% Significance Level    |       |  |
| 330 |  |  | <b>Data appear Normal at 5% Significance Level</b>                                                                                        |        |  |                                                |       |  |
| 331 |  |  |                                                                                                                                           |        |  |                                                |       |  |
| 332 |  |  | <b>Assuming Normal Distribution</b>                                                                                                       |        |  |                                                |       |  |
| 333 |  |  | <b>95% Normal UCL</b>                                                                                                                     |        |  | <b>95% UCLs (Adjusted for Skewness)</b>        |       |  |
| 334 |  |  | 95% Student's-t UCL                                                                                                                       | 6.544  |  | 95% Adjusted-CLT UCL (Chen-1995)               | 6.582 |  |
| 335 |  |  |                                                                                                                                           |        |  | 95% Modified-t UCL (Johnson-1978)              | 6.552 |  |

| A   | B                                                                                                                                        | C      | D                                                               | E | F | G | H                                   | I                                       | J     | K | L |  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------------------|---|---|---|-------------------------------------|-----------------------------------------|-------|---|---|--|
| 336 |                                                                                                                                          |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 337 | <b>Gamma GOF Test</b>                                                                                                                    |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 338 | A-D Test Statistic                                                                                                                       | 0.405  | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |   |                                     |                                         |       |   |   |  |
| 339 | 5% A-D Critical Value                                                                                                                    | 0.747  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |                                     |                                         |       |   |   |  |
| 340 | K-S Test Statistic                                                                                                                       | 0.103  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |   |                                     |                                         |       |   |   |  |
| 341 | 5% K-S Critical Value                                                                                                                    | 0.147  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |                                     |                                         |       |   |   |  |
| 342 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 343 |                                                                                                                                          |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 344 | <b>Gamma Statistics</b>                                                                                                                  |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 345 | k hat (MLE)                                                                                                                              | 15.11  |                                                                 |   |   |   |                                     | k star (bias corrected MLE)             | 13.87 |   |   |  |
| 346 | Theta hat (MLE)                                                                                                                          | 0.403  |                                                                 |   |   |   |                                     | Theta star (bias corrected MLE)         | 0.439 |   |   |  |
| 347 | nu hat (MLE)                                                                                                                             | 1088   |                                                                 |   |   |   |                                     | nu star (bias corrected)                | 998.8 |   |   |  |
| 348 | MLE Mean (bias corrected)                                                                                                                | 6.087  |                                                                 |   |   |   |                                     | MLE Sd (bias corrected)                 | 1.634 |   |   |  |
| 349 |                                                                                                                                          |        |                                                                 |   |   |   | Approximate Chi Square Value (0.05) | 926.5                                   |       |   |   |  |
| 350 | Adjusted Level of Significance                                                                                                           | 0.0428 |                                                                 |   |   |   |                                     | Adjusted Chi Square Value               | 923.3 |   |   |  |
| 351 |                                                                                                                                          |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 352 | <b>Assuming Gamma Distribution</b>                                                                                                       |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 353 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | 6.562  |                                                                 |   |   |   |                                     | 95% Adjusted Gamma UCL (use when n<50)) | 6.584 |   |   |  |
| 354 |                                                                                                                                          |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 355 | <b>Lognormal GOF Test</b>                                                                                                                |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 356 | Shapiro Wilk Test Statistic                                                                                                              | 0.975  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |   |                                     |                                         |       |   |   |  |
| 357 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.935  | Data appear Lognormal at 5% Significance Level                  |   |   |   |                                     |                                         |       |   |   |  |
| 358 | Lilliefors Test Statistic                                                                                                                | 0.117  | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |   |                                     |                                         |       |   |   |  |
| 359 | 5% Lilliefors Critical Value                                                                                                             | 0.145  | Data appear Lognormal at 5% Significance Level                  |   |   |   |                                     |                                         |       |   |   |  |
| 360 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 361 |                                                                                                                                          |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 362 | <b>Lognormal Statistics</b>                                                                                                              |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 363 | Minimum of Logged Data                                                                                                                   | 1.092  |                                                                 |   |   |   |                                     | Mean of logged Data                     | 1.773 |   |   |  |
| 364 | Maximum of Logged Data                                                                                                                   | 2.46   |                                                                 |   |   |   |                                     | SD of logged Data                       | 0.264 |   |   |  |
| 365 |                                                                                                                                          |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 366 | <b>Assuming Lognormal Distribution</b>                                                                                                   |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 367 | 95% H-UCL                                                                                                                                | 6.593  |                                                                 |   |   |   |                                     | 90% Chebyshev (MVUE) UCL                | 6.902 |   |   |  |
| 368 | 95% Chebyshev (MVUE) UCL                                                                                                                 | 7.27   |                                                                 |   |   |   |                                     | 97.5% Chebyshev (MVUE) UCL              | 7.782 |   |   |  |
| 369 | 99% Chebyshev (MVUE) UCL                                                                                                                 | 8.786  |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 370 |                                                                                                                                          |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 371 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 372 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 373 |                                                                                                                                          |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 374 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 375 | 95% CLT UCL                                                                                                                              | 6.532  |                                                                 |   |   |   |                                     | 95% Jackknife UCL                       | 6.544 |   |   |  |
| 376 | 95% Standard Bootstrap UCL                                                                                                               | 6.519  |                                                                 |   |   |   |                                     | 95% Bootstrap-t UCL                     | 6.615 |   |   |  |
| 377 | 95% Hall's Bootstrap UCL                                                                                                                 | 6.645  |                                                                 |   |   |   |                                     | 95% Percentile Bootstrap UCL            | 6.541 |   |   |  |
| 378 | 95% BCA Bootstrap UCL                                                                                                                    | 6.581  |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 379 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              | 6.898  |                                                                 |   |   |   |                                     | 95% Chebyshev(Mean, Sd) UCL             | 7.266 |   |   |  |
| 380 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            | 7.776  |                                                                 |   |   |   |                                     | 99% Chebyshev(Mean, Sd) UCL             | 8.778 |   |   |  |
| 381 |                                                                                                                                          |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 382 | <b>Suggested UCL to Use</b>                                                                                                              |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 383 | 95% Student's-t UCL                                                                                                                      | 6.544  |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 384 |                                                                                                                                          |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 385 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 386 | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 387 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 388 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 389 |                                                                                                                                          |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 390 |                                                                                                                                          |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 391 | <b>Result (eua_iron_soil-road)</b>                                                                                                       |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 392 |                                                                                                                                          |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 393 | <b>General Statistics</b>                                                                                                                |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 394 | Total Number of Observations                                                                                                             | 36     |                                                                 |   |   |   |                                     | Number of Distinct Observations         | 35    |   |   |  |
| 395 |                                                                                                                                          |        |                                                                 |   |   |   |                                     | Number of Missing Observations          | 0     |   |   |  |
| 396 | Minimum                                                                                                                                  | 10400  |                                                                 |   |   |   |                                     | Mean                                    | 28031 |   |   |  |
| 397 | Maximum                                                                                                                                  | 175000 |                                                                 |   |   |   |                                     | Median                                  | 23250 |   |   |  |
| 398 | SD                                                                                                                                       | 27240  |                                                                 |   |   |   |                                     | Std. Error of Mean                      | 4540  |   |   |  |
| 399 | Coefficient of Variation                                                                                                                 | 0.972  |                                                                 |   |   |   |                                     | Skewness                                | 4.849 |   |   |  |
| 400 |                                                                                                                                          |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 401 | <b>Normal GOF Test</b>                                                                                                                   |        |                                                                 |   |   |   |                                     |                                         |       |   |   |  |
| 402 | Shapiro Wilk Test Statistic                                                                                                              | 0.434  | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |                                     |                                         |       |   |   |  |

| A   | B                                                                                                                                        | C | D | E      | F                                                   | G | H | I     | J | K | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------|---|---|-------|---|---|---|
| 403 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.935  | Data Not Normal at 5% Significance Level            |   |   |       |   |   |   |
| 404 | Lilliefors Test Statistic                                                                                                                |   |   | 0.366  | <b>Lilliefors GOF Test</b>                          |   |   |       |   |   |   |
| 405 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.145  | Data Not Normal at 5% Significance Level            |   |   |       |   |   |   |
| 406 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 407 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 408 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |        |                                                     |   |   |       |   |   |   |
| 409 | <b>95% Normal UCL</b>                                                                                                                    |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>             |   |   |       |   |   |   |
| 410 | 95% Student's-t UCL                                                                                                                      |   |   | 35701  | 95% Adjusted-CLT UCL (Chen-1995)                    |   |   | 39419 |   |   |   |
| 411 |                                                                                                                                          |   |   |        | 95% Modified-t UCL (Johnson-1978)                   |   |   | 36313 |   |   |   |
| 412 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 413 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |        |                                                     |   |   |       |   |   |   |
| 414 | A-D Test Statistic                                                                                                                       |   |   | 3.28   | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |       |   |   |   |
| 415 | 5% A-D Critical Value                                                                                                                    |   |   | 0.754  | Data Not Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |
| 416 | K-S Test Statistic                                                                                                                       |   |   | 0.262  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |       |   |   |   |
| 417 | 5% K-S Critical Value                                                                                                                    |   |   | 0.148  | Data Not Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |
| 418 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |   |        |                                                     |   |   |       |   |   |   |
| 419 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 420 | <b>Gamma Statistics</b>                                                                                                                  |   |   |        |                                                     |   |   |       |   |   |   |
| 421 | k hat (MLE)                                                                                                                              |   |   | 3.039  | k star (bias corrected MLE)                         |   |   | 2.804 |   |   |   |
| 422 | Theta hat (MLE)                                                                                                                          |   |   | 9223   | Theta star (bias corrected MLE)                     |   |   | 9995  |   |   |   |
| 423 | nu hat (MLE)                                                                                                                             |   |   | 218.8  | nu star (bias corrected)                            |   |   | 201.9 |   |   |   |
| 424 | MLE Mean (bias corrected)                                                                                                                |   |   | 28031  | MLE Sd (bias corrected)                             |   |   | 16738 |   |   |   |
| 425 |                                                                                                                                          |   |   |        | Approximate Chi Square Value (0.05)                 |   |   | 170   |   |   |   |
| 426 | Adjusted Level of Significance                                                                                                           |   |   | 0.0428 | Adjusted Chi Square Value                           |   |   | 168.7 |   |   |   |
| 427 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 428 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |        |                                                     |   |   |       |   |   |   |
| 429 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |   | 33286  | 95% Adjusted Gamma UCL (use when n<50)              |   |   | 33547 |   |   |   |
| 430 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 431 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |        |                                                     |   |   |       |   |   |   |
| 432 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.822  | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |   |       |   |   |   |
| 433 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.935  | Data Not Lognormal at 5% Significance Level         |   |   |       |   |   |   |
| 434 | Lilliefors Test Statistic                                                                                                                |   |   | 0.195  | <b>Lilliefors Lognormal GOF Test</b>                |   |   |       |   |   |   |
| 435 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.145  | Data Not Lognormal at 5% Significance Level         |   |   |       |   |   |   |
| 436 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |   |   |        |                                                     |   |   |       |   |   |   |
| 437 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 438 | <b>Lognormal Statistics</b>                                                                                                              |   |   |        |                                                     |   |   |       |   |   |   |
| 439 | Minimum of Logged Data                                                                                                                   |   |   | 9.25   | Mean of logged Data                                 |   |   | 10.07 |   |   |   |
| 440 | Maximum of Logged Data                                                                                                                   |   |   | 12.07  | SD of logged Data                                   |   |   | 0.494 |   |   |   |
| 441 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 442 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |        |                                                     |   |   |       |   |   |   |
| 443 | 95% H-UCL                                                                                                                                |   |   | 31228  | 90% Chebyshev (MVUE) UCL                            |   |   | 33388 |   |   |   |
| 444 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 36494  | 97.5% Chebyshev (MVUE) UCL                          |   |   | 40805 |   |   |   |
| 445 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 49274  |                                                     |   |   |       |   |   |   |
| 446 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 447 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |                                                     |   |   |       |   |   |   |
| 448 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |   |   |        |                                                     |   |   |       |   |   |   |
| 449 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 450 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |        |                                                     |   |   |       |   |   |   |
| 451 | 95% CLT UCL                                                                                                                              |   |   | 35498  | 95% Jackknife UCL                                   |   |   | 35701 |   |   |   |
| 452 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 35428  | 95% Bootstrap-t UCL                                 |   |   | 55356 |   |   |   |
| 453 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 71180  | 95% Percentile Bootstrap UCL                        |   |   | 36375 |   |   |   |
| 454 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 42069  |                                                     |   |   |       |   |   |   |
| 455 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 41651  | 95% Chebyshev(Mean, Sd) UCL                         |   |   | 47820 |   |   |   |
| 456 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 56383  | 99% Chebyshev(Mean, Sd) UCL                         |   |   | 73204 |   |   |   |
| 457 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 458 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                     |   |   |       |   |   |   |
| 459 | 95% Student's-t UCL                                                                                                                      |   |   | 35701  | or 95% Modified-t UCL                               |   |   | 36313 |   |   |   |
| 460 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 461 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                     |   |   |       |   |   |   |
| 462 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                     |   |   |       |   |   |   |
| 463 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                     |   |   |       |   |   |   |
| 464 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                     |   |   |       |   |   |   |
| 465 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 466 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 467 | <b>Result (eua_manganese_soil-road)</b>                                                                                                  |   |   |        |                                                     |   |   |       |   |   |   |
| 468 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 469 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                     |   |   |       |   |   |   |

| A   | B                                                                                | C | D | E      | F                                                   | G | H | I     | J | K | L |
|-----|----------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------|---|---|-------|---|---|---|
| 470 | Total Number of Observations                                                     |   |   | 36     | Number of Distinct Observations                     |   |   | 34    |   |   |   |
| 471 |                                                                                  |   |   |        | Number of Missing Observations                      |   |   | 0     |   |   |   |
| 472 | Minimum                                                                          |   |   | 424    | Mean                                                |   |   | 1353  |   |   |   |
| 473 | Maximum                                                                          |   |   | 8990   | Median                                              |   |   | 873.5 |   |   |   |
| 474 | SD                                                                               |   |   | 1455   | Std. Error of Mean                                  |   |   | 242.4 |   |   |   |
| 475 | Coefficient of Variation                                                         |   |   | 1.075  | Skewness                                            |   |   | 4.41  |   |   |   |
| 476 |                                                                                  |   |   |        |                                                     |   |   |       |   |   |   |
| 477 | <b>Normal GOF Test</b>                                                           |   |   |        |                                                     |   |   |       |   |   |   |
| 478 | Shapiro Wilk Test Statistic                                                      |   |   | 0.52   | <b>Shapiro Wilk GOF Test</b>                        |   |   |       |   |   |   |
| 479 | 5% Shapiro Wilk Critical Value                                                   |   |   | 0.935  | Data Not Normal at 5% Significance Level            |   |   |       |   |   |   |
| 480 | Lilliefors Test Statistic                                                        |   |   | 0.273  | <b>Lilliefors GOF Test</b>                          |   |   |       |   |   |   |
| 481 | 5% Lilliefors Critical Value                                                     |   |   | 0.145  | Data Not Normal at 5% Significance Level            |   |   |       |   |   |   |
| 482 | <b>Data Not Normal at 5% Significance Level</b>                                  |   |   |        |                                                     |   |   |       |   |   |   |
| 483 |                                                                                  |   |   |        |                                                     |   |   |       |   |   |   |
| 484 | <b>Assuming Normal Distribution</b>                                              |   |   |        |                                                     |   |   |       |   |   |   |
| 485 | <b>95% Normal UCL</b>                                                            |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>             |   |   |       |   |   |   |
| 486 | 95% Student's-t UCL                                                              |   |   | 1763   | 95% Adjusted-CLT UCL (Chen-1995)                    |   |   | 1942  |   |   |   |
| 487 |                                                                                  |   |   |        | 95% Modified-t UCL (Johnson-1978)                   |   |   | 1792  |   |   |   |
| 488 |                                                                                  |   |   |        |                                                     |   |   |       |   |   |   |
| 489 | <b>Gamma GOF Test</b>                                                            |   |   |        |                                                     |   |   |       |   |   |   |
| 490 | A-D Test Statistic                                                               |   |   | 1.982  | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |       |   |   |   |
| 491 | 5% A-D Critical Value                                                            |   |   | 0.758  | Data Not Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |
| 492 | K-S Test Statistic                                                               |   |   | 0.181  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |       |   |   |   |
| 493 | 5% K-S Critical Value                                                            |   |   | 0.149  | Data Not Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |
| 494 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                       |   |   |        |                                                     |   |   |       |   |   |   |
| 495 |                                                                                  |   |   |        |                                                     |   |   |       |   |   |   |
| 496 | <b>Gamma Statistics</b>                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 497 | k hat (MLE)                                                                      |   |   | 2.209  | k star (bias corrected MLE)                         |   |   | 2.044 |   |   |   |
| 498 | Theta hat (MLE)                                                                  |   |   | 612.5  | Theta star (bias corrected MLE)                     |   |   | 662.1 |   |   |   |
| 499 | nu hat (MLE)                                                                     |   |   | 159.1  | nu star (bias corrected)                            |   |   | 147.2 |   |   |   |
| 500 | MLE Mean (bias corrected)                                                        |   |   | 1353   | MLE Sd (bias corrected)                             |   |   | 946.5 |   |   |   |
| 501 |                                                                                  |   |   |        | Approximate Chi Square Value (0.05)                 |   |   | 120.1 |   |   |   |
| 502 | Adjusted Level of Significance                                                   |   |   | 0.0428 | Adjusted Chi Square Value                           |   |   | 119   |   |   |   |
| 503 |                                                                                  |   |   |        |                                                     |   |   |       |   |   |   |
| 504 | <b>Assuming Gamma Distribution</b>                                               |   |   |        |                                                     |   |   |       |   |   |   |
| 505 | 95% Approximate Gamma UCL (use when n>=50))                                      |   |   | 1658   | 95% Adjusted Gamma UCL (use when n<50)              |   |   | 1673  |   |   |   |
| 506 |                                                                                  |   |   |        |                                                     |   |   |       |   |   |   |
| 507 | <b>Lognormal GOF Test</b>                                                        |   |   |        |                                                     |   |   |       |   |   |   |
| 508 | Shapiro Wilk Test Statistic                                                      |   |   | 0.907  | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |   |       |   |   |   |
| 509 | 5% Shapiro Wilk Critical Value                                                   |   |   | 0.935  | Data Not Lognormal at 5% Significance Level         |   |   |       |   |   |   |
| 510 | Lilliefors Test Statistic                                                        |   |   | 0.145  | <b>Lilliefors Lognormal GOF Test</b>                |   |   |       |   |   |   |
| 511 | 5% Lilliefors Critical Value                                                     |   |   | 0.145  | Data appear Lognormal at 5% Significance Level      |   |   |       |   |   |   |
| 512 | <b>Data appear Approximate Lognormal at 5% Significance Level</b>                |   |   |        |                                                     |   |   |       |   |   |   |
| 513 |                                                                                  |   |   |        |                                                     |   |   |       |   |   |   |
| 514 | <b>Lognormal Statistics</b>                                                      |   |   |        |                                                     |   |   |       |   |   |   |
| 515 | Minimum of Logged Data                                                           |   |   | 6.05   | Mean of logged Data                                 |   |   | 6.967 |   |   |   |
| 516 | Maximum of Logged Data                                                           |   |   | 9.104  | SD of logged Data                                   |   |   | 0.61  |   |   |   |
| 517 |                                                                                  |   |   |        |                                                     |   |   |       |   |   |   |
| 518 | <b>Assuming Lognormal Distribution</b>                                           |   |   |        |                                                     |   |   |       |   |   |   |
| 519 | 95% H-UCL                                                                        |   |   | 1571   | 90% Chebyshev (MVUE) UCL                            |   |   | 1685  |   |   |   |
| 520 | 95% Chebyshev (MVUE) UCL                                                         |   |   | 1872   | 97.5% Chebyshev (MVUE) UCL                          |   |   | 2133  |   |   |   |
| 521 | 99% Chebyshev (MVUE) UCL                                                         |   |   | 2644   |                                                     |   |   |       |   |   |   |
| 522 |                                                                                  |   |   |        |                                                     |   |   |       |   |   |   |
| 523 | <b>Nonparametric Distribution Free UCL Statistics</b>                            |   |   |        |                                                     |   |   |       |   |   |   |
| 524 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b> |   |   |        |                                                     |   |   |       |   |   |   |
| 525 |                                                                                  |   |   |        |                                                     |   |   |       |   |   |   |
| 526 | <b>Nonparametric Distribution Free UCLs</b>                                      |   |   |        |                                                     |   |   |       |   |   |   |
| 527 | 95% CLT UCL                                                                      |   |   | 1752   | 95% Jackknife UCL                                   |   |   | 1763  |   |   |   |
| 528 | 95% Standard Bootstrap UCL                                                       |   |   | 1754   | 95% Bootstrap-t UCL                                 |   |   | 2278  |   |   |   |
| 529 | 95% Hall's Bootstrap UCL                                                         |   |   | 3291   | 95% Percentile Bootstrap UCL                        |   |   | 1798  |   |   |   |
| 530 | 95% BCA Bootstrap UCL                                                            |   |   | 2110   |                                                     |   |   |       |   |   |   |
| 531 | 90% Chebyshev(Mean, Sd) UCL                                                      |   |   | 2080   | 95% Chebyshev(Mean, Sd) UCL                         |   |   | 2410  |   |   |   |
| 532 | 97.5% Chebyshev(Mean, Sd) UCL                                                    |   |   | 2867   | 99% Chebyshev(Mean, Sd) UCL                         |   |   | 3765  |   |   |   |
| 533 |                                                                                  |   |   |        |                                                     |   |   |       |   |   |   |
| 534 | <b>Suggested UCL to Use</b>                                                      |   |   |        |                                                     |   |   |       |   |   |   |
| 535 | 95% H-UCL                                                                        |   |   | 1571   |                                                     |   |   |       |   |   |   |
| 536 |                                                                                  |   |   |        |                                                     |   |   |       |   |   |   |

| A   | B                                                                                                                                         | C      | E | F | G | H | I                                                            | J      | K | L |  |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------|--------|---|---|---|---|--------------------------------------------------------------|--------|---|---|--|
| 537 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |        |   |   |   |   |                                                              |        |   |   |  |
| 538 | Recommendations are based upon data size, data distribution, and skewness.                                                                |        |   |   |   |   |                                                              |        |   |   |  |
| 539 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |        |   |   |   |   |                                                              |        |   |   |  |
| 540 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |        |   |   |   |   |                                                              |        |   |   |  |
| 541 |                                                                                                                                           |        |   |   |   |   |                                                              |        |   |   |  |
| 542 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                    |        |   |   |   |   |                                                              |        |   |   |  |
| 543 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>             |        |   |   |   |   |                                                              |        |   |   |  |
| 544 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                        |        |   |   |   |   |                                                              |        |   |   |  |
| 545 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>         |        |   |   |   |   |                                                              |        |   |   |  |
| 546 |                                                                                                                                           |        |   |   |   |   |                                                              |        |   |   |  |
| 547 | <b>Result (eua_thallium_soil-road)</b>                                                                                                    |        |   |   |   |   |                                                              |        |   |   |  |
| 548 |                                                                                                                                           |        |   |   |   |   |                                                              |        |   |   |  |
| 549 | <b>General Statistics</b>                                                                                                                 |        |   |   |   |   |                                                              |        |   |   |  |
| 550 | Total Number of Observations                                                                                                              | 36     |   |   |   |   | Number of Distinct Observations                              | 22     |   |   |  |
| 551 | Number of Detects                                                                                                                         | 29     |   |   |   |   | Number of Non-Detects                                        | 7      |   |   |  |
| 552 | Number of Distinct Detects                                                                                                                | 17     |   |   |   |   | Number of Distinct Non-Detects                               | 5      |   |   |  |
| 553 | Minimum Detect                                                                                                                            | 0.06   |   |   |   |   | Minimum Non-Detect                                           | 0.499  |   |   |  |
| 554 | Maximum Detect                                                                                                                            | 0.95   |   |   |   |   | Maximum Non-Detect                                           | 0.506  |   |   |  |
| 555 | Variance Detects                                                                                                                          | 0.0276 |   |   |   |   | Percent Non-Detects                                          | 19.44% |   |   |  |
| 556 | Mean Detects                                                                                                                              | 0.171  |   |   |   |   | SD Detects                                                   | 0.166  |   |   |  |
| 557 | Median Detects                                                                                                                            | 0.13   |   |   |   |   | CV Detects                                                   | 0.971  |   |   |  |
| 558 | Skewness Detects                                                                                                                          | 3.994  |   |   |   |   | Kurtosis Detects                                             | 18.22  |   |   |  |
| 559 | Mean of Logged Detects                                                                                                                    | -1.978 |   |   |   |   | SD of Logged Detects                                         | 0.578  |   |   |  |
| 560 |                                                                                                                                           |        |   |   |   |   |                                                              |        |   |   |  |
| 561 | <b>Normal GOF Test on Detects Only</b>                                                                                                    |        |   |   |   |   |                                                              |        |   |   |  |
| 562 | Shapiro Wilk Test Statistic                                                                                                               | 0.538  |   |   |   |   | <b>Shapiro Wilk GOF Test</b>                                 |        |   |   |  |
| 563 | 5% Shapiro Wilk Critical Value                                                                                                            | 0.926  |   |   |   |   | Detected Data Not Normal at 5% Significance Level            |        |   |   |  |
| 564 | Lilliefors Test Statistic                                                                                                                 | 0.304  |   |   |   |   | <b>Lilliefors GOF Test</b>                                   |        |   |   |  |
| 565 | 5% Lilliefors Critical Value                                                                                                              | 0.161  |   |   |   |   | Detected Data Not Normal at 5% Significance Level            |        |   |   |  |
| 566 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                  |        |   |   |   |   |                                                              |        |   |   |  |
| 567 |                                                                                                                                           |        |   |   |   |   |                                                              |        |   |   |  |
| 568 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                             |        |   |   |   |   |                                                              |        |   |   |  |
| 569 | KM Mean                                                                                                                                   | 0.166  |   |   |   |   | KM Standard Error of Mean                                    | 0.0262 |   |   |  |
| 570 | KM SD                                                                                                                                     | 0.15   |   |   |   |   | 95% KM (BCA) UCL                                             | 0.212  |   |   |  |
| 571 | 95% KM (t) UCL                                                                                                                            | 0.21   |   |   |   |   | 95% KM (Percentile Bootstrap) UCL                            | 0.216  |   |   |  |
| 572 | 95% KM (z) UCL                                                                                                                            | 0.209  |   |   |   |   | 95% KM Bootstrap t UCL                                       | 0.258  |   |   |  |
| 573 | 90% KM Chebyshev UCL                                                                                                                      | 0.244  |   |   |   |   | 95% KM Chebyshev UCL                                         | 0.28   |   |   |  |
| 574 | 97.5% KM Chebyshev UCL                                                                                                                    | 0.329  |   |   |   |   | 99% KM Chebyshev UCL                                         | 0.427  |   |   |  |
| 575 |                                                                                                                                           |        |   |   |   |   |                                                              |        |   |   |  |
| 576 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                      |        |   |   |   |   |                                                              |        |   |   |  |
| 577 | A-D Test Statistic                                                                                                                        | 1.535  |   |   |   |   | <b>Anderson-Darling GOF Test</b>                             |        |   |   |  |
| 578 | 5% A-D Critical Value                                                                                                                     | 0.755  |   |   |   |   | Detected Data Not Gamma Distributed at 5% Significance Level |        |   |   |  |
| 579 | K-S Test Statistic                                                                                                                        | 0.19   |   |   |   |   | <b>Kolmogorov-Smirnov GOF</b>                                |        |   |   |  |
| 580 | 5% K-S Critical Value                                                                                                                     | 0.164  |   |   |   |   | Detected Data Not Gamma Distributed at 5% Significance Level |        |   |   |  |
| 581 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                                       |        |   |   |   |   |                                                              |        |   |   |  |
| 582 |                                                                                                                                           |        |   |   |   |   |                                                              |        |   |   |  |
| 583 | <b>Gamma Statistics on Detected Data Only</b>                                                                                             |        |   |   |   |   |                                                              |        |   |   |  |
| 584 | k hat (MLE)                                                                                                                               | 2.505  |   |   |   |   | k star (bias corrected MLE)                                  | 2.269  |   |   |  |
| 585 | Theta hat (MLE)                                                                                                                           | 0.0683 |   |   |   |   | Theta star (bias corrected MLE)                              | 0.0755 |   |   |  |
| 586 | nu hat (MLE)                                                                                                                              | 145.3  |   |   |   |   | nu star (bias corrected)                                     | 131.6  |   |   |  |
| 587 | Mean (detects)                                                                                                                            | 0.171  |   |   |   |   |                                                              |        |   |   |  |
| 588 |                                                                                                                                           |        |   |   |   |   |                                                              |        |   |   |  |
| 589 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                     |        |   |   |   |   |                                                              |        |   |   |  |
| 590 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                              |        |   |   |   |   |                                                              |        |   |   |  |
| 591 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                 |        |   |   |   |   |                                                              |        |   |   |  |
| 592 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                              |        |   |   |   |   |                                                              |        |   |   |  |
| 593 | This is especially true when the sample size is small.                                                                                    |        |   |   |   |   |                                                              |        |   |   |  |
| 594 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                               |        |   |   |   |   |                                                              |        |   |   |  |
| 595 | Minimum                                                                                                                                   | 0.06   |   |   |   |   | Mean                                                         | 0.165  |   |   |  |
| 596 | Maximum                                                                                                                                   | 0.95   |   |   |   |   | Median                                                       | 0.133  |   |   |  |
| 597 | SD                                                                                                                                        | 0.15   |   |   |   |   | CV                                                           | 0.912  |   |   |  |
| 598 | k hat (MLE)                                                                                                                               | 2.874  |   |   |   |   | k star (bias corrected MLE)                                  | 2.653  |   |   |  |
| 599 | Theta hat (MLE)                                                                                                                           | 0.0574 |   |   |   |   | Theta star (bias corrected MLE)                              | 0.0622 |   |   |  |
| 600 | nu hat (MLE)                                                                                                                              | 206.9  |   |   |   |   | nu star (bias corrected)                                     | 191    |   |   |  |
| 601 | Adjusted Level of Significance ( $\beta$ )                                                                                                | 0.0428 |   |   |   |   |                                                              |        |   |   |  |
| 602 | Approximate Chi Square Value (191.00, $\alpha$ )                                                                                          | 160    |   |   |   |   | Adjusted Chi Square Value (191.00, $\beta$ )                 | 158.7  |   |   |  |
| 603 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                                         | 0.197  |   |   |   |   | 95% Gamma Adjusted UCL (use when $n < 50$ )                  | 0.199  |   |   |  |

| A   | B                                                                                                                                         | C      | D                                                       | E | F | G                           | H | I | J | K | L |        |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------|--------|---------------------------------------------------------|---|---|-----------------------------|---|---|---|---|---|--------|
| 604 |                                                                                                                                           |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 605 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                   |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 606 | Mean (KM)                                                                                                                                 | 0.166  | SD (KM)                                                 |   |   |                             |   |   |   |   |   | 0.15   |
| 607 | Variance (KM)                                                                                                                             | 0.0226 | SE of Mean (KM)                                         |   |   |                             |   |   |   |   |   | 0.0262 |
| 608 | k hat (KM)                                                                                                                                | 1.215  | k star (KM)                                             |   |   |                             |   |   |   |   |   | 1.132  |
| 609 | nu hat (KM)                                                                                                                               | 87.47  | nu star (KM)                                            |   |   |                             |   |   |   |   |   | 81.51  |
| 610 | theta hat (KM)                                                                                                                            | 0.136  | theta star (KM)                                         |   |   |                             |   |   |   |   |   | 0.146  |
| 611 | 80% gamma percentile (KM)                                                                                                                 | 0.264  | 90% gamma percentile (KM)                               |   |   |                             |   |   |   |   |   | 0.37   |
| 612 | 95% gamma percentile (KM)                                                                                                                 | 0.475  | 99% gamma percentile (KM)                               |   |   |                             |   |   |   |   |   | 0.718  |
| 613 |                                                                                                                                           |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 614 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                 |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 615 | Approximate Chi Square Value (81.51, $\alpha$ )                                                                                           | 61.71  | Adjusted Chi Square Value (81.51, $\beta$ )             |   |   |                             |   |   |   |   |   | 60.92  |
| 616 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                       | 0.219  | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )          |   |   |                             |   |   |   |   |   | 0.222  |
| 617 |                                                                                                                                           |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 618 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                   |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 619 | Shapiro Wilk Test Statistic                                                                                                               | 0.898  | <b>Shapiro Wilk GOF Test</b>                            |   |   |                             |   |   |   |   |   |        |
| 620 | 5% Shapiro Wilk Critical Value                                                                                                            | 0.926  | Detected Data Not Lognormal at 5% Significance Level    |   |   |                             |   |   |   |   |   |        |
| 621 | Lilliefors Test Statistic                                                                                                                 | 0.132  | <b>Lilliefors GOF Test</b>                              |   |   |                             |   |   |   |   |   |        |
| 622 | 5% Lilliefors Critical Value                                                                                                              | 0.161  | Detected Data appear Lognormal at 5% Significance Level |   |   |                             |   |   |   |   |   |        |
| 623 | <b>Detected Data appear Approximate Lognormal at 5% Significance Level</b>                                                                |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 624 |                                                                                                                                           |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 625 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                 |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 626 | Mean in Original Scale                                                                                                                    | 0.164  | Mean in Log Scale                                       |   |   |                             |   |   |   |   |   | -1.984 |
| 627 | SD in Original Scale                                                                                                                      | 0.15   | SD in Log Scale                                         |   |   |                             |   |   |   |   |   | 0.524  |
| 628 | 95% t UCL (assumes normality of ROS data)                                                                                                 | 0.206  | 95% Percentile Bootstrap UCL                            |   |   |                             |   |   |   |   |   | 0.211  |
| 629 | 95% BCA Bootstrap UCL                                                                                                                     | 0.236  | 95% Bootstrap t UCL                                     |   |   |                             |   |   |   |   |   | 0.267  |
| 630 | 95% H-UCL (Log ROS)                                                                                                                       | 0.187  |                                                         |   |   |                             |   |   |   |   |   |        |
| 631 |                                                                                                                                           |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 632 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                   |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 633 | KM Mean (logged)                                                                                                                          | -1.991 | KM Geo Mean                                             |   |   |                             |   |   |   |   |   | 0.137  |
| 634 | KM SD (logged)                                                                                                                            | 0.547  | 95% Critical H Value (KM-Log)                           |   |   |                             |   |   |   |   |   | 1.946  |
| 635 | KM Standard Error of Mean (logged)                                                                                                        | 0.0999 | 95% H-UCL (KM -Log)                                     |   |   |                             |   |   |   |   |   | 0.19   |
| 636 | KM SD (logged)                                                                                                                            | 0.547  | 95% Critical H Value (KM-Log)                           |   |   |                             |   |   |   |   |   | 1.946  |
| 637 | KM Standard Error of Mean (logged)                                                                                                        | 0.0999 |                                                         |   |   |                             |   |   |   |   |   |        |
| 638 |                                                                                                                                           |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 639 | <b>DL/2 Statistics</b>                                                                                                                    |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 640 | <b>DL/2 Normal</b>                                                                                                                        |        |                                                         |   |   | <b>DL/2 Log-Transformed</b> |   |   |   |   |   |        |
| 641 | Mean in Original Scale                                                                                                                    | 0.187  | Mean in Log Scale                                       |   |   |                             |   |   |   |   |   | -1.862 |
| 642 | SD in Original Scale                                                                                                                      | 0.152  | SD in Log Scale                                         |   |   |                             |   |   |   |   |   | 0.57   |
| 643 | 95% t UCL (Assumes normality)                                                                                                             | 0.229  | 95% H-Stat UCL                                          |   |   |                             |   |   |   |   |   | 0.221  |
| 644 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                  |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 645 |                                                                                                                                           |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 646 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                     |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 647 | <b>Detected Data appear Approximate Lognormal Distributed at 5% Significance Level</b>                                                    |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 648 |                                                                                                                                           |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 649 | <b>Suggested UCL to Use</b>                                                                                                               |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 650 | KM H-UCL                                                                                                                                  | 0.19   |                                                         |   |   |                             |   |   |   |   |   |        |
| 651 |                                                                                                                                           |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 652 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 653 | Recommendations are based upon data size, data distribution, and skewness.                                                                |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 654 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 655 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 656 |                                                                                                                                           |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 657 |                                                                                                                                           |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 658 | <b>Result (eua_zinc_soil-road)</b>                                                                                                        |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 659 |                                                                                                                                           |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 660 | <b>General Statistics</b>                                                                                                                 |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 661 | Total Number of Observations                                                                                                              | 36     | Number of Distinct Observations                         |   |   |                             |   |   |   |   |   | 36     |
| 662 |                                                                                                                                           |        | Number of Missing Observations                          |   |   |                             |   |   |   |   |   | 0      |
| 663 | Minimum                                                                                                                                   | 130    | Mean                                                    |   |   |                             |   |   |   |   |   | 455.1  |
| 664 | Maximum                                                                                                                                   | 2120   | Median                                                  |   |   |                             |   |   |   |   |   | 282.5  |
| 665 | SD                                                                                                                                        | 408.1  | Std. Error of Mean                                      |   |   |                             |   |   |   |   |   | 68.01  |
| 666 | Coefficient of Variation                                                                                                                  | 0.897  | Skewness                                                |   |   |                             |   |   |   |   |   | 2.481  |
| 667 |                                                                                                                                           |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 668 | <b>Normal GOF Test</b>                                                                                                                    |        |                                                         |   |   |                             |   |   |   |   |   |        |
| 669 | Shapiro Wilk Test Statistic                                                                                                               | 0.709  | <b>Shapiro Wilk GOF Test</b>                            |   |   |                             |   |   |   |   |   |        |
| 670 | 5% Shapiro Wilk Critical Value                                                                                                            | 0.935  | Data Not Normal at 5% Significance Level                |   |   |                             |   |   |   |   |   |        |

| A   | B                                                                                                                                        | C | D                                           | E | F      | G                                                   | H | I | J                                      | K | L     |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---------------------------------------------|---|--------|-----------------------------------------------------|---|---|----------------------------------------|---|-------|
| 671 |                                                                                                                                          |   | Lilliefors Test Statistic                   |   | 0.221  | <b>Lilliefors GOF Test</b>                          |   |   |                                        |   |       |
| 672 |                                                                                                                                          |   | 5% Lilliefors Critical Value                |   | 0.145  | Data Not Normal at 5% Significance Level            |   |   |                                        |   |       |
| 673 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 674 |                                                                                                                                          |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 675 | <b>Assuming Normal Distribution</b>                                                                                                      |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 676 | <b>95% Normal UCL</b>                                                                                                                    |   |                                             |   |        | <b>95% UCLs (Adjusted for Skewness)</b>             |   |   |                                        |   |       |
| 677 |                                                                                                                                          |   | 95% Student's-t UCL                         |   | 570    |                                                     |   |   | 95% Adjusted-CLT UCL (Chen-1995)       |   | 597   |
| 678 |                                                                                                                                          |   |                                             |   |        |                                                     |   |   | 95% Modified-t UCL (Johnson-1978)      |   | 574.7 |
| 679 |                                                                                                                                          |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 680 | <b>Gamma GOF Test</b>                                                                                                                    |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 681 |                                                                                                                                          |   | A-D Test Statistic                          |   | 1.74   | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |                                        |   |       |
| 682 |                                                                                                                                          |   | 5% A-D Critical Value                       |   | 0.759  | Data Not Gamma Distributed at 5% Significance Level |   |   |                                        |   |       |
| 683 |                                                                                                                                          |   | K-S Test Statistic                          |   | 0.173  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |                                        |   |       |
| 684 |                                                                                                                                          |   | 5% K-S Critical Value                       |   | 0.149  | Data Not Gamma Distributed at 5% Significance Level |   |   |                                        |   |       |
| 685 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 686 |                                                                                                                                          |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 687 | <b>Gamma Statistics</b>                                                                                                                  |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 688 |                                                                                                                                          |   | k hat (MLE)                                 |   | 2.078  |                                                     |   |   | k star (bias corrected MLE)            |   | 1.924 |
| 689 |                                                                                                                                          |   | Theta hat (MLE)                             |   | 218.9  |                                                     |   |   | Theta star (bias corrected MLE)        |   | 236.5 |
| 690 |                                                                                                                                          |   | nu hat (MLE)                                |   | 149.7  |                                                     |   |   | nu star (bias corrected)               |   | 138.5 |
| 691 |                                                                                                                                          |   | MLE Mean (bias corrected)                   |   | 455.1  |                                                     |   |   | MLE Sd (bias corrected)                |   | 328.1 |
| 692 |                                                                                                                                          |   |                                             |   |        |                                                     |   |   | Approximate Chi Square Value (0.05)    |   | 112.3 |
| 693 |                                                                                                                                          |   | Adjusted Level of Significance              |   | 0.0428 |                                                     |   |   | Adjusted Chi Square Value              |   | 111.2 |
| 694 |                                                                                                                                          |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 695 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 696 |                                                                                                                                          |   | 95% Approximate Gamma UCL (use when n>=50)) |   | 561.2  |                                                     |   |   | 95% Adjusted Gamma UCL (use when n<50) |   | 566.6 |
| 697 |                                                                                                                                          |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 698 | <b>Lognormal GOF Test</b>                                                                                                                |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 699 |                                                                                                                                          |   | Shapiro Wilk Test Statistic                 |   | 0.916  | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |   |                                        |   |       |
| 700 |                                                                                                                                          |   | 5% Shapiro Wilk Critical Value              |   | 0.935  | Data Not Lognormal at 5% Significance Level         |   |   |                                        |   |       |
| 701 |                                                                                                                                          |   | Lilliefors Test Statistic                   |   | 0.152  | <b>Lilliefors Lognormal GOF Test</b>                |   |   |                                        |   |       |
| 702 |                                                                                                                                          |   | 5% Lilliefors Critical Value                |   | 0.145  | Data Not Lognormal at 5% Significance Level         |   |   |                                        |   |       |
| 703 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 704 |                                                                                                                                          |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 705 | <b>Lognormal Statistics</b>                                                                                                              |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 706 |                                                                                                                                          |   | Minimum of Logged Data                      |   | 4.868  |                                                     |   |   | Mean of logged Data                    |   | 5.861 |
| 707 |                                                                                                                                          |   | Maximum of Logged Data                      |   | 7.659  |                                                     |   |   | SD of logged Data                      |   | 0.676 |
| 708 |                                                                                                                                          |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 709 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 710 |                                                                                                                                          |   | 95% H-UCL                                   |   | 557.8  |                                                     |   |   | 90% Chebyshev (MVUE) UCL               |   | 597.9 |
| 711 |                                                                                                                                          |   | 95% Chebyshev (MVUE) UCL                    |   | 670.3  |                                                     |   |   | 97.5% Chebyshev (MVUE) UCL             |   | 771   |
| 712 |                                                                                                                                          |   | 99% Chebyshev (MVUE) UCL                    |   | 968.6  |                                                     |   |   |                                        |   |       |
| 713 |                                                                                                                                          |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 714 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 715 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 716 |                                                                                                                                          |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 717 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 718 |                                                                                                                                          |   | 95% CLT UCL                                 |   | 566.9  |                                                     |   |   | 95% Jackknife UCL                      |   | 570   |
| 719 |                                                                                                                                          |   | 95% Standard Bootstrap UCL                  |   | 563.8  |                                                     |   |   | 95% Bootstrap-t UCL                    |   | 616.6 |
| 720 |                                                                                                                                          |   | 95% Hall's Bootstrap UCL                    |   | 658.9  |                                                     |   |   | 95% Percentile Bootstrap UCL           |   | 573.2 |
| 721 |                                                                                                                                          |   | 95% BCA Bootstrap UCL                       |   | 599    |                                                     |   |   |                                        |   |       |
| 722 |                                                                                                                                          |   | 90% Chebyshev(Mean, Sd) UCL                 |   | 659.1  |                                                     |   |   | 95% Chebyshev(Mean, Sd) UCL            |   | 751.5 |
| 723 |                                                                                                                                          |   | 97.5% Chebyshev(Mean, Sd) UCL               |   | 879.8  |                                                     |   |   | 99% Chebyshev(Mean, Sd) UCL            |   | 1132  |
| 724 |                                                                                                                                          |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 725 | <b>Suggested UCL to Use</b>                                                                                                              |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 726 |                                                                                                                                          |   | 95% Chebyshev (Mean, Sd) UCL                |   | 751.5  |                                                     |   |   |                                        |   |       |
| 727 |                                                                                                                                          |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 728 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 729 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 730 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 731 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |                                             |   |        |                                                     |   |   |                                        |   |       |
| 732 |                                                                                                                                          |   |                                             |   |        |                                                     |   |   |                                        |   |       |

| A  | B                                                                                                                         | C                              | D | E | F | G | H | I                                                            | J      | K | L |  |
|----|---------------------------------------------------------------------------------------------------------------------------|--------------------------------|---|---|---|---|---|--------------------------------------------------------------|--------|---|---|--|
| 1  | <b>UCL Statistics for Data Sets with Non-Detects</b>                                                                      |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 2  |                                                                                                                           |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 3  | User Selected Options                                                                                                     |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 4  | Date/Time of Computation                                                                                                  | ProUCL 5.12/4/2019 11:44:03 AM |   |   |   |   |   |                                                              |        |   |   |  |
| 5  | From File                                                                                                                 | BPMD_HHRA_ATVRec_SoilInput.xls |   |   |   |   |   |                                                              |        |   |   |  |
| 6  | Full Precision                                                                                                            | OFF                            |   |   |   |   |   |                                                              |        |   |   |  |
| 7  | Confidence Coefficient                                                                                                    | 95%                            |   |   |   |   |   |                                                              |        |   |   |  |
| 8  | Number of Bootstrap Operations                                                                                            | 2000                           |   |   |   |   |   |                                                              |        |   |   |  |
| 9  |                                                                                                                           |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 10 | <b>Result (eu5b_antimony_soil-road)</b>                                                                                   |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 11 |                                                                                                                           |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 12 | <b>General Statistics</b>                                                                                                 |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 13 | Total Number of Observations                                                                                              | 85                             |   |   |   |   |   | Number of Distinct Observations                              | 70     |   |   |  |
| 14 | Number of Detects                                                                                                         | 84                             |   |   |   |   |   | Number of Non-Detects                                        | 1      |   |   |  |
| 15 | Number of Distinct Detects                                                                                                | 70                             |   |   |   |   |   | Number of Distinct Non-Detects                               | 1      |   |   |  |
| 16 | Minimum Detect                                                                                                            | 0.21                           |   |   |   |   |   | Minimum Non-Detect                                           | 1.1    |   |   |  |
| 17 | Maximum Detect                                                                                                            | 187                            |   |   |   |   |   | Maximum Non-Detect                                           | 1.1    |   |   |  |
| 18 | Variance Detects                                                                                                          | 493.8                          |   |   |   |   |   | Percent Non-Detects                                          | 1.1769 |   |   |  |
| 19 | Mean Detects                                                                                                              | 5.638                          |   |   |   |   |   | SD Detects                                                   | 22.22  |   |   |  |
| 20 | Median Detects                                                                                                            | 1                              |   |   |   |   |   | CV Detects                                                   | 3.942  |   |   |  |
| 21 | Skewness Detects                                                                                                          | 7.155                          |   |   |   |   |   | Kurtosis Detects                                             | 55.75  |   |   |  |
| 22 | Mean of Logged Detects                                                                                                    | 0.331                          |   |   |   |   |   | SD of Logged Detects                                         | 1.249  |   |   |  |
| 23 |                                                                                                                           |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 24 | <b>Normal GOF Test on Detects Only</b>                                                                                    |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 25 | Shapiro Wilk Test Statistic                                                                                               | 0.252                          |   |   |   |   |   | <b>Normal GOF Test on Detected Observations Only</b>         |        |   |   |  |
| 26 | 5% Shapiro Wilk P Value                                                                                                   | 0                              |   |   |   |   |   | Detected Data Not Normal at 5% Significance Level            |        |   |   |  |
| 27 | Lilliefors Test Statistic                                                                                                 | 0.41                           |   |   |   |   |   | <b>Lilliefors GOF Test</b>                                   |        |   |   |  |
| 28 | 5% Lilliefors Critical Value                                                                                              | 0.0968                         |   |   |   |   |   | Detected Data Not Normal at 5% Significance Level            |        |   |   |  |
| 29 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                  |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 30 |                                                                                                                           |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 31 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 32 | KM Mean                                                                                                                   | 5.579                          |   |   |   |   |   | KM Standard Error of Mean                                    | 2.397  |   |   |  |
| 33 | KM SD                                                                                                                     | 21.97                          |   |   |   |   |   | 95% KM (BCA) UCL                                             | 10.51  |   |   |  |
| 34 | 95% KM (t) UCL                                                                                                            | 9.565                          |   |   |   |   |   | 95% KM (Percentile Bootstrap) UCL                            | 9.919  |   |   |  |
| 35 | 95% KM (z) UCL                                                                                                            | 9.521                          |   |   |   |   |   | 95% KM Bootstrap t UCL                                       | 20.35  |   |   |  |
| 36 | 90% KM Chebyshev UCL                                                                                                      | 12.77                          |   |   |   |   |   | 95% KM Chebyshev UCL                                         | 16.03  |   |   |  |
| 37 | 97.5% KM Chebyshev UCL                                                                                                    | 20.55                          |   |   |   |   |   | 99% KM Chebyshev UCL                                         | 29.43  |   |   |  |
| 38 |                                                                                                                           |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 39 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 40 | A-D Test Statistic                                                                                                        | 10.59                          |   |   |   |   |   | <b>Anderson-Darling GOF Test</b>                             |        |   |   |  |
| 41 | 5% A-D Critical Value                                                                                                     | 0.828                          |   |   |   |   |   | Detected Data Not Gamma Distributed at 5% Significance Level |        |   |   |  |
| 42 | K-S Test Statistic                                                                                                        | 0.243                          |   |   |   |   |   | <b>Kolmogorov-Smirnov GOF</b>                                |        |   |   |  |
| 43 | 5% K-S Critical Value                                                                                                     | 0.104                          |   |   |   |   |   | Detected Data Not Gamma Distributed at 5% Significance Level |        |   |   |  |
| 44 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                       |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 45 |                                                                                                                           |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 46 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 47 | k hat (MLE)                                                                                                               | 0.46                           |   |   |   |   |   | k star (bias corrected MLE)                                  | 0.452  |   |   |  |
| 48 | Theta hat (MLE)                                                                                                           | 12.25                          |   |   |   |   |   | Theta star (bias corrected MLE)                              | 12.48  |   |   |  |
| 49 | nu hat (MLE)                                                                                                              | 77.31                          |   |   |   |   |   | nu star (bias corrected)                                     | 75.88  |   |   |  |
| 50 | Mean (detects)                                                                                                            | 5.638                          |   |   |   |   |   |                                                              |        |   |   |  |
| 51 |                                                                                                                           |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 52 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 53 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 54 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 55 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 56 | This is especially true when the sample size is small.                                                                    |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 57 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |                                |   |   |   |   |   |                                                              |        |   |   |  |
| 58 | Minimum                                                                                                                   | 0.01                           |   |   |   |   |   | Mean                                                         | 5.571  |   |   |  |
| 59 | Maximum                                                                                                                   | 187                            |   |   |   |   |   | Median                                                       | 1      |   |   |  |
| 60 | SD                                                                                                                        | 22.1                           |   |   |   |   |   | CV                                                           | 3.966  |   |   |  |
| 61 | k hat (MLE)                                                                                                               | 0.447                          |   |   |   |   |   | k star (bias corrected MLE)                                  | 0.439  |   |   |  |
| 62 | Theta hat (MLE)                                                                                                           | 12.45                          |   |   |   |   |   | Theta star (bias corrected MLE)                              | 12.68  |   |   |  |
| 63 | nu hat (MLE)                                                                                                              | 76.06                          |   |   |   |   |   | nu star (bias corrected)                                     | 74.71  |   |   |  |
| 64 | Adjusted Level of Significance ( $\beta$ )                                                                                | 0.0472                         |   |   |   |   |   |                                                              |        |   |   |  |
| 65 | Approximate Chi Square Value (74.71, $\alpha$ )                                                                           | 55.8                           |   |   |   |   |   | Adjusted Chi Square Value (74.71, $\beta$ )                  | 55.52  |   |   |  |
| 66 | 95% Gamma Approximate UCL (use when n>=50)                                                                                | 7.459                          |   |   |   |   |   | 95% Gamma Adjusted UCL (use when n<50)                       | 7.497  |   |   |  |
| 67 |                                                                                                                           |                                |   |   |   |   |   |                                                              |        |   |   |  |

| A   | B                                                                                                                                         | C | D         | E | F                                                    | G                           | H      | I | J | K | L |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------|---|-----------|---|------------------------------------------------------|-----------------------------|--------|---|---|---|---|
| 68  | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                   |   |           |   |                                                      |                             |        |   |   |   |   |
| 69  | Mean (KM)                                                                                                                                 |   | 5.579     |   | SD (KM)                                              |                             | 21.97  |   |   |   |   |
| 70  | Variance (KM)                                                                                                                             |   | 482.5     |   | SE of Mean (KM)                                      |                             | 2.397  |   |   |   |   |
| 71  | k hat (KM)                                                                                                                                |   | 0.0645    |   | k star (KM)                                          |                             | 0.0701 |   |   |   |   |
| 72  | nu hat (KM)                                                                                                                               |   | 10.97     |   | nu star (KM)                                         |                             | 11.91  |   |   |   |   |
| 73  | theta hat (KM)                                                                                                                            |   | 86.48     |   | theta star (KM)                                      |                             | 79.61  |   |   |   |   |
| 74  | 80% gamma percentile (KM)                                                                                                                 |   | 2.003     |   | 90% gamma percentile (KM)                            |                             | 12.05  |   |   |   |   |
| 75  | 95% gamma percentile (KM)                                                                                                                 |   | 32.09     |   | 99% gamma percentile (KM)                            |                             | 105.1  |   |   |   |   |
| 76  |                                                                                                                                           |   |           |   |                                                      |                             |        |   |   |   |   |
| 77  | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                 |   |           |   |                                                      |                             |        |   |   |   |   |
| 78  | Approximate Chi Square Value (11.91, $\alpha$ )                                                                                           |   | 5.169     |   | Adjusted Chi Square Value (11.91, $\beta$ )          |                             | 5.093  |   |   |   |   |
| 79  | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                       |   | 12.86     |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )       |                             | 13.05  |   |   |   |   |
| 80  |                                                                                                                                           |   |           |   |                                                      |                             |        |   |   |   |   |
| 81  | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                   |   |           |   |                                                      |                             |        |   |   |   |   |
| 82  | Shapiro Wilk Approximate Test Statistic                                                                                                   |   | 0.886     |   | <b>Shapiro Wilk GOF Test</b>                         |                             |        |   |   |   |   |
| 83  | 5% Shapiro Wilk P Value                                                                                                                   |   | 1.4545E-8 |   | Detected Data Not Lognormal at 5% Significance Level |                             |        |   |   |   |   |
| 84  | Lilliefors Test Statistic                                                                                                                 |   | 0.146     |   | <b>Lilliefors GOF Test</b>                           |                             |        |   |   |   |   |
| 85  | 5% Lilliefors Critical Value                                                                                                              |   | 0.0968    |   | Detected Data Not Lognormal at 5% Significance Level |                             |        |   |   |   |   |
| 86  | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                                               |   |           |   |                                                      |                             |        |   |   |   |   |
| 87  |                                                                                                                                           |   |           |   |                                                      |                             |        |   |   |   |   |
| 88  | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                 |   |           |   |                                                      |                             |        |   |   |   |   |
| 89  | Mean in Original Scale                                                                                                                    |   | 5.579     |   | Mean in Log Scale                                    |                             | 0.322  |   |   |   |   |
| 90  | SD in Original Scale                                                                                                                      |   | 22.1      |   | SD in Log Scale                                      |                             | 1.244  |   |   |   |   |
| 91  | 95% t UCL (assumes normality of ROS data)                                                                                                 |   | 9.565     |   | 95% Percentile Bootstrap UCL                         |                             | 9.751  |   |   |   |   |
| 92  | 95% BCA Bootstrap UCL                                                                                                                     |   | 13.1      |   | 95% Bootstrap t UCL                                  |                             | 20.8   |   |   |   |   |
| 93  | 95% H-UCL (Log ROS)                                                                                                                       |   | 4.194     |   |                                                      |                             |        |   |   |   |   |
| 94  |                                                                                                                                           |   |           |   |                                                      |                             |        |   |   |   |   |
| 95  | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                   |   |           |   |                                                      |                             |        |   |   |   |   |
| 96  | KM Mean (logged)                                                                                                                          |   | 0.321     |   | KM Geo Mean                                          |                             | 1.378  |   |   |   |   |
| 97  | KM SD (logged)                                                                                                                            |   | 1.239     |   | 95% Critical H Value (KM-Log)                        |                             | 2.478  |   |   |   |   |
| 98  | KM Standard Error of Mean (logged)                                                                                                        |   | 0.135     |   | 95% H-UCL (KM -Log)                                  |                             | 4.149  |   |   |   |   |
| 99  | KM SD (logged)                                                                                                                            |   | 1.239     |   | 95% Critical H Value (KM-Log)                        |                             | 2.478  |   |   |   |   |
| 100 | KM Standard Error of Mean (logged)                                                                                                        |   | 0.135     |   |                                                      |                             |        |   |   |   |   |
| 101 |                                                                                                                                           |   |           |   |                                                      |                             |        |   |   |   |   |
| 102 | <b>DL/2 Statistics</b>                                                                                                                    |   |           |   |                                                      |                             |        |   |   |   |   |
| 103 | <b>DL/2 Normal</b>                                                                                                                        |   |           |   |                                                      | <b>DL/2 Log-Transformed</b> |        |   |   |   |   |
| 104 | Mean in Original Scale                                                                                                                    |   | 5.578     |   | Mean in Log Scale                                    |                             | 0.32   |   |   |   |   |
| 105 | SD in Original Scale                                                                                                                      |   | 22.1      |   | SD in Log Scale                                      |                             | 1.246  |   |   |   |   |
| 106 | 95% t UCL (Assumes normality)                                                                                                             |   | 9.564     |   | 95% H-Stat UCL                                       |                             | 4.195  |   |   |   |   |
| 107 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                  |   |           |   |                                                      |                             |        |   |   |   |   |
| 108 |                                                                                                                                           |   |           |   |                                                      |                             |        |   |   |   |   |
| 109 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                     |   |           |   |                                                      |                             |        |   |   |   |   |
| 110 | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                             |   |           |   |                                                      |                             |        |   |   |   |   |
| 111 |                                                                                                                                           |   |           |   |                                                      |                             |        |   |   |   |   |
| 112 | <b>Suggested UCL to Use</b>                                                                                                               |   |           |   |                                                      |                             |        |   |   |   |   |
| 113 | 95% KM (Chebyshev) UCL                                                                                                                    |   | 16.03     |   |                                                      |                             |        |   |   |   |   |
| 114 |                                                                                                                                           |   |           |   |                                                      |                             |        |   |   |   |   |
| 115 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |   |           |   |                                                      |                             |        |   |   |   |   |
| 116 | Recommendations are based upon data size, data distribution, and skewness.                                                                |   |           |   |                                                      |                             |        |   |   |   |   |
| 117 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |   |           |   |                                                      |                             |        |   |   |   |   |
| 118 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |   |           |   |                                                      |                             |        |   |   |   |   |
| 119 |                                                                                                                                           |   |           |   |                                                      |                             |        |   |   |   |   |
| 120 |                                                                                                                                           |   |           |   |                                                      |                             |        |   |   |   |   |
| 121 | <b>Result (eu5b_arsenic_soil-road)</b>                                                                                                    |   |           |   |                                                      |                             |        |   |   |   |   |
| 122 |                                                                                                                                           |   |           |   |                                                      |                             |        |   |   |   |   |
| 123 | <b>General Statistics</b>                                                                                                                 |   |           |   |                                                      |                             |        |   |   |   |   |
| 124 | Total Number of Observations                                                                                                              |   | 85        |   | Number of Distinct Observations                      |                             | 82     |   |   |   |   |
| 125 |                                                                                                                                           |   |           |   | Number of Missing Observations                       |                             | 0      |   |   |   |   |
| 126 | Minimum                                                                                                                                   |   | 3.19      |   | Mean                                                 |                             | 39.72  |   |   |   |   |
| 127 | Maximum                                                                                                                                   |   | 259       |   | Median                                               |                             | 27.2   |   |   |   |   |
| 128 | SD                                                                                                                                        |   | 40.48     |   | Std. Error of Mean                                   |                             | 4.391  |   |   |   |   |
| 129 | Coefficient of Variation                                                                                                                  |   | 1.019     |   | Skewness                                             |                             | 2.655  |   |   |   |   |
| 130 |                                                                                                                                           |   |           |   |                                                      |                             |        |   |   |   |   |
| 131 | <b>Normal GOF Test</b>                                                                                                                    |   |           |   |                                                      |                             |        |   |   |   |   |
| 132 | Shapiro Wilk Test Statistic                                                                                                               |   | 0.762     |   | <b>Shapiro Wilk GOF Test</b>                         |                             |        |   |   |   |   |
| 133 | 5% Shapiro Wilk P Value                                                                                                                   |   | 0         |   | Data Not Normal at 5% Significance Level             |                             |        |   |   |   |   |
| 134 | Lilliefors Test Statistic                                                                                                                 |   | 0.183     |   | <b>Lilliefors GOF Test</b>                           |                             |        |   |   |   |   |

| A   | B                                                                                                                                         | C | D | E      | F                                                               | G | H | I | J     | K | L |  |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------------------|---|---|---|-------|---|---|--|
| 135 | 5% Lilliefors Critical Value                                                                                                              |   |   | 0.0962 | Data Not Normal at 5% Significance Level                        |   |   |   |       |   |   |  |
| 136 | <b>Data Not Normal at 5% Significance Level</b>                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 137 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 138 | <b>Assuming Normal Distribution</b>                                                                                                       |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 139 | <b>95% Normal UCL</b>                                                                                                                     |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |   |       |   |   |  |
| 140 | 95% Student's-t UCL                                                                                                                       |   |   | 47.03  | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |   | 48.3  |   |   |  |
| 141 |                                                                                                                                           |   |   |        | 95% Modified-t UCL (Johnson-1978)                               |   |   |   | 47.24 |   |   |  |
| 142 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 143 | <b>Gamma GOF Test</b>                                                                                                                     |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 144 | A-D Test Statistic                                                                                                                        |   |   | 0.694  | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |   |       |   |   |  |
| 145 | 5% A-D Critical Value                                                                                                                     |   |   | 0.775  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |       |   |   |  |
| 146 | K-S Test Statistic                                                                                                                        |   |   | 0.0823 | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |   |       |   |   |  |
| 147 | 5% K-S Critical Value                                                                                                                     |   |   | 0.0992 | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |       |   |   |  |
| 148 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                    |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 149 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 150 | <b>Gamma Statistics</b>                                                                                                                   |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 151 | k hat (MLE)                                                                                                                               |   |   | 1.3    | k star (bias corrected MLE)                                     |   |   |   | 1.262 |   |   |  |
| 152 | Theta hat (MLE)                                                                                                                           |   |   | 30.55  | Theta star (bias corrected MLE)                                 |   |   |   | 31.47 |   |   |  |
| 153 | nu hat (MLE)                                                                                                                              |   |   | 221    | nu star (bias corrected)                                        |   |   |   | 214.6 |   |   |  |
| 154 | MLE Mean (bias corrected)                                                                                                                 |   |   | 39.72  | MLE Sd (bias corrected)                                         |   |   |   | 35.36 |   |   |  |
| 155 |                                                                                                                                           |   |   |        | Approximate Chi Square Value (0.05)                             |   |   |   | 181.7 |   |   |  |
| 156 | Adjusted Level of Significance                                                                                                            |   |   | 0.0472 | Adjusted Chi Square Value                                       |   |   |   | 181.2 |   |   |  |
| 157 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 158 | <b>Assuming Gamma Distribution</b>                                                                                                        |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 159 | 95% Approximate Gamma UCL (use when n>=50)                                                                                                |   |   | 46.92  | 95% Adjusted Gamma UCL (use when n<50)                          |   |   |   | 47.05 |   |   |  |
| 160 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 161 | <b>Lognormal GOF Test</b>                                                                                                                 |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 162 | Shapiro Wilk Test Statistic                                                                                                               |   |   | 0.975  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |   |       |   |   |  |
| 163 | 5% Shapiro Wilk P Value                                                                                                                   |   |   | 0.329  | Data appear Lognormal at 5% Significance Level                  |   |   |   |       |   |   |  |
| 164 | Lilliefors Test Statistic                                                                                                                 |   |   | 0.0619 | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |   |       |   |   |  |
| 165 | 5% Lilliefors Critical Value                                                                                                              |   |   | 0.0962 | Data appear Lognormal at 5% Significance Level                  |   |   |   |       |   |   |  |
| 166 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                     |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 167 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 168 | <b>Lognormal Statistics</b>                                                                                                               |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 169 | Minimum of Logged Data                                                                                                                    |   |   | 1.16   | Mean of logged Data                                             |   |   |   | 3.25  |   |   |  |
| 170 | Maximum of Logged Data                                                                                                                    |   |   | 5.557  | SD of logged Data                                               |   |   |   | 0.964 |   |   |  |
| 171 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 172 | <b>Assuming Lognormal Distribution</b>                                                                                                    |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 173 | 95% H-UCL                                                                                                                                 |   |   | 51.77  | 90% Chebyshev (MVUE) UCL                                        |   |   |   | 55.85 |   |   |  |
| 174 | 95% Chebyshev (MVUE) UCL                                                                                                                  |   |   | 62.7   | 97.5% Chebyshev (MVUE) UCL                                      |   |   |   | 72.2  |   |   |  |
| 175 | 99% Chebyshev (MVUE) UCL                                                                                                                  |   |   | 90.87  |                                                                 |   |   |   |       |   |   |  |
| 176 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 177 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                     |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 178 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                          |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 179 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 180 | <b>Nonparametric Distribution Free UCLs</b>                                                                                               |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 181 | 95% CLT UCL                                                                                                                               |   |   | 46.95  | 95% Jackknife UCL                                               |   |   |   | 47.03 |   |   |  |
| 182 | 95% Standard Bootstrap UCL                                                                                                                |   |   | 47.01  | 95% Bootstrap-t UCL                                             |   |   |   | 48.97 |   |   |  |
| 183 | 95% Hall's Bootstrap UCL                                                                                                                  |   |   | 49.84  | 95% Percentile Bootstrap UCL                                    |   |   |   | 46.73 |   |   |  |
| 184 | 95% BCA Bootstrap UCL                                                                                                                     |   |   | 47.53  |                                                                 |   |   |   |       |   |   |  |
| 185 | 90% Chebyshev(Mean, Sd) UCL                                                                                                               |   |   | 52.9   | 95% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 58.86 |   |   |  |
| 186 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                             |   |   | 67.15  | 99% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 83.41 |   |   |  |
| 187 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 188 | <b>Suggested UCL to Use</b>                                                                                                               |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 189 | 95% Approximate Gamma UCL                                                                                                                 |   |   | 46.92  |                                                                 |   |   |   |       |   |   |  |
| 190 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 191 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 192 | Recommendations are based upon data size, data distribution, and skewness.                                                                |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 193 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 194 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 195 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 196 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 197 | <b>Result (eu5b_cadmium_soil-road)</b>                                                                                                    |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 198 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 199 | <b>General Statistics</b>                                                                                                                 |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 200 | Total Number of Observations                                                                                                              |   |   | 85     | Number of Distinct Observations                                 |   |   |   | 70    |   |   |  |
| 201 |                                                                                                                                           |   |   |        | Number of Missing Observations                                  |   |   |   | 0     |   |   |  |

| A   | B                                                                                                                            | C | D | E                                           | F      | G                                       | H | I | J | K                                                   | L     |
|-----|------------------------------------------------------------------------------------------------------------------------------|---|---|---------------------------------------------|--------|-----------------------------------------|---|---|---|-----------------------------------------------------|-------|
| 202 |                                                                                                                              |   |   | Minimum                                     | 0.045  |                                         |   |   |   | Mean                                                | 3.393 |
| 203 |                                                                                                                              |   |   | Maximum                                     | 41.5   |                                         |   |   |   | Median                                              | 1.6   |
| 204 |                                                                                                                              |   |   | SD                                          | 5.941  |                                         |   |   |   | Std. Error of Mean                                  | 0.644 |
| 205 |                                                                                                                              |   |   | Coefficient of Variation                    | 1.751  |                                         |   |   |   | Skewness                                            | 4.2   |
| 206 |                                                                                                                              |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 207 | <b>Normal GOF Test</b>                                                                                                       |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 208 |                                                                                                                              |   |   | Shapiro Wilk Test Statistic                 | 0.536  |                                         |   |   |   | <b>Shapiro Wilk GOF Test</b>                        |       |
| 209 |                                                                                                                              |   |   | 5% Shapiro Wilk P Value                     | 0      |                                         |   |   |   | Data Not Normal at 5% Significance Level            |       |
| 210 |                                                                                                                              |   |   | Lilliefors Test Statistic                   | 0.311  |                                         |   |   |   | <b>Lilliefors GOF Test</b>                          |       |
| 211 |                                                                                                                              |   |   | 5% Lilliefors Critical Value                | 0.0962 |                                         |   |   |   | Data Not Normal at 5% Significance Level            |       |
| 212 | <b>Data Not Normal at 5% Significance Level</b>                                                                              |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 213 |                                                                                                                              |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 214 | <b>Assuming Normal Distribution</b>                                                                                          |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 215 | <b>95% Normal UCL</b>                                                                                                        |   |   |                                             |        | <b>95% UCLs (Adjusted for Skewness)</b> |   |   |   |                                                     |       |
| 216 |                                                                                                                              |   |   | 95% Student's-t UCL                         | 4.465  |                                         |   |   |   | 95% Adjusted-CLT UCL (Chen-1995)                    | 4.767 |
| 217 |                                                                                                                              |   |   |                                             |        |                                         |   |   |   | 95% Modified-t UCL (Johnson-1978)                   | 4.514 |
| 218 |                                                                                                                              |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 219 | <b>Gamma GOF Test</b>                                                                                                        |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 220 |                                                                                                                              |   |   | A-D Test Statistic                          | 2.327  |                                         |   |   |   | <b>Anderson-Darling Gamma GOF Test</b>              |       |
| 221 |                                                                                                                              |   |   | 5% A-D Critical Value                       | 0.795  |                                         |   |   |   | Data Not Gamma Distributed at 5% Significance Level |       |
| 222 |                                                                                                                              |   |   | K-S Test Statistic                          | 0.158  |                                         |   |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |       |
| 223 |                                                                                                                              |   |   | 5% K-S Critical Value                       | 0.101  |                                         |   |   |   | Data Not Gamma Distributed at 5% Significance Level |       |
| 224 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 225 |                                                                                                                              |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 226 | <b>Gamma Statistics</b>                                                                                                      |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 227 |                                                                                                                              |   |   | k hat (MLE)                                 | 0.73   |                                         |   |   |   | k star (bias corrected MLE)                         | 0.712 |
| 228 |                                                                                                                              |   |   | Theta hat (MLE)                             | 4.651  |                                         |   |   |   | Theta star (bias corrected MLE)                     | 4.768 |
| 229 |                                                                                                                              |   |   | nu hat (MLE)                                | 124    |                                         |   |   |   | nu star (bias corrected)                            | 121   |
| 230 |                                                                                                                              |   |   | MLE Mean (bias corrected)                   | 3.393  |                                         |   |   |   | MLE Sd (bias corrected)                             | 4.022 |
| 231 |                                                                                                                              |   |   |                                             |        |                                         |   |   |   | Approximate Chi Square Value (0.05)                 | 96.58 |
| 232 |                                                                                                                              |   |   | Adjusted Level of Significance              | 0.0472 |                                         |   |   |   | Adjusted Chi Square Value                           | 96.21 |
| 233 |                                                                                                                              |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 234 | <b>Assuming Gamma Distribution</b>                                                                                           |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 235 |                                                                                                                              |   |   | 95% Approximate Gamma UCL (use when n>=50)) | 4.251  |                                         |   |   |   | 95% Adjusted Gamma UCL (use when n<50)              | 4.267 |
| 236 |                                                                                                                              |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 237 | <b>Lognormal GOF Test</b>                                                                                                    |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 238 |                                                                                                                              |   |   | Shapiro Wilk Test Statistic                 | 0.979  |                                         |   |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>              |       |
| 239 |                                                                                                                              |   |   | 5% Shapiro Wilk P Value                     | 0.51   |                                         |   |   |   | Data appear Lognormal at 5% Significance Level      |       |
| 240 |                                                                                                                              |   |   | Lilliefors Test Statistic                   | 0.0771 |                                         |   |   |   | <b>Lilliefors Lognormal GOF Test</b>                |       |
| 241 |                                                                                                                              |   |   | 5% Lilliefors Critical Value                | 0.0962 |                                         |   |   |   | Data appear Lognormal at 5% Significance Level      |       |
| 242 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                        |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 243 |                                                                                                                              |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 244 | <b>Lognormal Statistics</b>                                                                                                  |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 245 |                                                                                                                              |   |   | Minimum of Logged Data                      | -3.101 |                                         |   |   |   | Mean of logged Data                                 | 0.398 |
| 246 |                                                                                                                              |   |   | Maximum of Logged Data                      | 3.726  |                                         |   |   |   | SD of logged Data                                   | 1.317 |
| 247 |                                                                                                                              |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 248 | <b>Assuming Lognormal Distribution</b>                                                                                       |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 249 |                                                                                                                              |   |   | 95% H-UCL                                   | 5.12   |                                         |   |   |   | 90% Chebyshev (MVUE) UCL                            | 5.427 |
| 250 |                                                                                                                              |   |   | 95% Chebyshev (MVUE) UCL                    | 6.31   |                                         |   |   |   | 97.5% Chebyshev (MVUE) UCL                          | 7.535 |
| 251 |                                                                                                                              |   |   | 99% Chebyshev (MVUE) UCL                    | 9.941  |                                         |   |   |   |                                                     |       |
| 252 |                                                                                                                              |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 253 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                        |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 254 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                             |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 255 |                                                                                                                              |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 256 | <b>Nonparametric Distribution Free UCLs</b>                                                                                  |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 257 |                                                                                                                              |   |   | 95% CLT UCL                                 | 4.453  |                                         |   |   |   | 95% Jackknife UCL                                   | 4.465 |
| 258 |                                                                                                                              |   |   | 95% Standard Bootstrap UCL                  | 4.436  |                                         |   |   |   | 95% Bootstrap-t UCL                                 | 5.039 |
| 259 |                                                                                                                              |   |   | 95% Hall's Bootstrap UCL                    | 5.312  |                                         |   |   |   | 95% Percentile Bootstrap UCL                        | 4.517 |
| 260 |                                                                                                                              |   |   | 95% BCA Bootstrap UCL                       | 4.803  |                                         |   |   |   |                                                     |       |
| 261 |                                                                                                                              |   |   | 90% Chebyshev(Mean, Sd) UCL                 | 5.326  |                                         |   |   |   | 95% Chebyshev(Mean, Sd) UCL                         | 6.202 |
| 262 |                                                                                                                              |   |   | 97.5% Chebyshev(Mean, Sd) UCL               | 7.417  |                                         |   |   |   | 99% Chebyshev(Mean, Sd) UCL                         | 9.805 |
| 263 |                                                                                                                              |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 264 | <b>Suggested UCL to Use</b>                                                                                                  |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 265 |                                                                                                                              |   |   | 95% H-UCL                                   | 5.12   |                                         |   |   |   |                                                     |       |
| 266 |                                                                                                                              |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 267 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. |   |   |                                             |        |                                         |   |   |   |                                                     |       |
| 268 | Recommendations are based upon data size, data distribution, and skewness.                                                   |   |   |                                             |        |                                         |   |   |   |                                                     |       |

| A   | B                                                                                                                                        | C         | E                                                               | F | G     | H | I | J | K | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------------------------------------------------------------|---|-------|---|---|---|---|---|
| 269 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |           |                                                                 |   |       |   |   |   |   |   |
| 270 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |           |                                                                 |   |       |   |   |   |   |   |
| 271 |                                                                                                                                          |           |                                                                 |   |       |   |   |   |   |   |
| 272 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |           |                                                                 |   |       |   |   |   |   |   |
| 273 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |           |                                                                 |   |       |   |   |   |   |   |
| 274 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |           |                                                                 |   |       |   |   |   |   |   |
| 275 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |           |                                                                 |   |       |   |   |   |   |   |
| 276 |                                                                                                                                          |           |                                                                 |   |       |   |   |   |   |   |
| 277 |                                                                                                                                          |           |                                                                 |   |       |   |   |   |   |   |
| 278 | <b>Result (eu5b_chromium_soil-road)</b>                                                                                                  |           |                                                                 |   |       |   |   |   |   |   |
| 279 |                                                                                                                                          |           |                                                                 |   |       |   |   |   |   |   |
| 280 | <b>General Statistics</b>                                                                                                                |           |                                                                 |   |       |   |   |   |   |   |
| 281 | Total Number of Observations                                                                                                             | 85        | Number of Distinct Observations                                 |   | 51    |   |   |   |   |   |
| 282 |                                                                                                                                          |           | Number of Missing Observations                                  |   | 0     |   |   |   |   |   |
| 283 | Minimum                                                                                                                                  | 2.2       | Mean                                                            |   | 4.782 |   |   |   |   |   |
| 284 | Maximum                                                                                                                                  | 15.7      | Median                                                          |   | 4.6   |   |   |   |   |   |
| 285 | SD                                                                                                                                       | 2.051     | Std. Error of Mean                                              |   | 0.222 |   |   |   |   |   |
| 286 | Coefficient of Variation                                                                                                                 | 0.429     | Skewness                                                        |   | 2.032 |   |   |   |   |   |
| 287 |                                                                                                                                          |           |                                                                 |   |       |   |   |   |   |   |
| 288 | <b>Normal GOF Test</b>                                                                                                                   |           |                                                                 |   |       |   |   |   |   |   |
| 289 | Shapiro Wilk Test Statistic                                                                                                              | 0.868     | <b>Shapiro Wilk GOF Test</b>                                    |   |       |   |   |   |   |   |
| 290 | 5% Shapiro Wilk P Value                                                                                                                  | 2.401E-10 | Data Not Normal at 5% Significance Level                        |   |       |   |   |   |   |   |
| 291 | Lilliefors Test Statistic                                                                                                                | 0.105     | <b>Lilliefors GOF Test</b>                                      |   |       |   |   |   |   |   |
| 292 | 5% Lilliefors Critical Value                                                                                                             | 0.0962    | Data Not Normal at 5% Significance Level                        |   |       |   |   |   |   |   |
| 293 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |           |                                                                 |   |       |   |   |   |   |   |
| 294 |                                                                                                                                          |           |                                                                 |   |       |   |   |   |   |   |
| 295 | <b>Assuming Normal Distribution</b>                                                                                                      |           |                                                                 |   |       |   |   |   |   |   |
| 296 | <b>95% Normal UCL</b>                                                                                                                    |           | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |       |   |   |   |   |   |
| 297 | 95% Student's-t UCL                                                                                                                      | 5.152     | 95% Adjusted-CLT UCL (Chen-1995)                                |   | 5.201 |   |   |   |   |   |
| 298 |                                                                                                                                          |           | 95% Modified-t UCL (Johnson-1978)                               |   | 5.161 |   |   |   |   |   |
| 299 |                                                                                                                                          |           |                                                                 |   |       |   |   |   |   |   |
| 300 | <b>Gamma GOF Test</b>                                                                                                                    |           |                                                                 |   |       |   |   |   |   |   |
| 301 | A-D Test Statistic                                                                                                                       | 0.516     | <b>Anderson-Darling Gamma GOF Test</b>                          |   |       |   |   |   |   |   |
| 302 | 5% A-D Critical Value                                                                                                                    | 0.754     | Detected data appear Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |   |
| 303 | K-S Test Statistic                                                                                                                       | 0.0724    | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |       |   |   |   |   |   |
| 304 | 5% K-S Critical Value                                                                                                                    | 0.0971    | Detected data appear Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |   |
| 305 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |           |                                                                 |   |       |   |   |   |   |   |
| 306 |                                                                                                                                          |           |                                                                 |   |       |   |   |   |   |   |
| 307 | <b>Gamma Statistics</b>                                                                                                                  |           |                                                                 |   |       |   |   |   |   |   |
| 308 | k hat (MLE)                                                                                                                              | 6.659     | k star (bias corrected MLE)                                     |   | 6.432 |   |   |   |   |   |
| 309 | Theta hat (MLE)                                                                                                                          | 0.718     | Theta star (bias corrected MLE)                                 |   | 0.744 |   |   |   |   |   |
| 310 | nu hat (MLE)                                                                                                                             | 1132      | nu star (bias corrected)                                        |   | 1093  |   |   |   |   |   |
| 311 | MLE Mean (bias corrected)                                                                                                                | 4.782     | MLE Sd (bias corrected)                                         |   | 1.886 |   |   |   |   |   |
| 312 |                                                                                                                                          |           | Approximate Chi Square Value (0.05)                             |   | 1018  |   |   |   |   |   |
| 313 | Adjusted Level of Significance                                                                                                           | 0.0472    | Adjusted Chi Square Value                                       |   | 1016  |   |   |   |   |   |
| 314 |                                                                                                                                          |           |                                                                 |   |       |   |   |   |   |   |
| 315 | <b>Assuming Gamma Distribution</b>                                                                                                       |           |                                                                 |   |       |   |   |   |   |   |
| 316 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               | 5.139     | 95% Adjusted Gamma UCL (use when n<50)                          |   | 5.145 |   |   |   |   |   |
| 317 |                                                                                                                                          |           |                                                                 |   |       |   |   |   |   |   |
| 318 | <b>Lognormal GOF Test</b>                                                                                                                |           |                                                                 |   |       |   |   |   |   |   |
| 319 | Shapiro Wilk Test Statistic                                                                                                              | 0.969     | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |       |   |   |   |   |   |
| 320 | 5% Shapiro Wilk P Value                                                                                                                  | 0.162     | Data appear Lognormal at 5% Significance Level                  |   |       |   |   |   |   |   |
| 321 | Lilliefors Test Statistic                                                                                                                | 0.0773    | <b>Lilliefors Lognormal GOF Test</b>                            |   |       |   |   |   |   |   |
| 322 | 5% Lilliefors Critical Value                                                                                                             | 0.0962    | Data appear Lognormal at 5% Significance Level                  |   |       |   |   |   |   |   |
| 323 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |           |                                                                 |   |       |   |   |   |   |   |
| 324 |                                                                                                                                          |           |                                                                 |   |       |   |   |   |   |   |
| 325 | <b>Lognormal Statistics</b>                                                                                                              |           |                                                                 |   |       |   |   |   |   |   |
| 326 | Minimum of Logged Data                                                                                                                   | 0.788     | Mean of logged Data                                             |   | 1.488 |   |   |   |   |   |
| 327 | Maximum of Logged Data                                                                                                                   | 2.754     | SD of logged Data                                               |   | 0.388 |   |   |   |   |   |
| 328 |                                                                                                                                          |           |                                                                 |   |       |   |   |   |   |   |
| 329 | <b>Assuming Lognormal Distribution</b>                                                                                                   |           |                                                                 |   |       |   |   |   |   |   |
| 330 | 95% H-UCL                                                                                                                                | 5.149     | 90% Chebyshev (MVUE) UCL                                        |   | 5.393 |   |   |   |   |   |
| 331 | 95% Chebyshev (MVUE) UCL                                                                                                                 | 5.675     | 97.5% Chebyshev (MVUE) UCL                                      |   | 6.067 |   |   |   |   |   |
| 332 | 99% Chebyshev (MVUE) UCL                                                                                                                 | 6.836     |                                                                 |   |       |   |   |   |   |   |
| 333 |                                                                                                                                          |           |                                                                 |   |       |   |   |   |   |   |
| 334 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |           |                                                                 |   |       |   |   |   |   |   |
| 335 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |           |                                                                 |   |       |   |   |   |   |   |

| A   | B                                                                                                                                        | C | D      | E                                                   | F | G | H | I | J | K | L     |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|-----------------------------------------------------|---|---|---|---|---|---|-------|
| 336 |                                                                                                                                          |   |        |                                                     |   |   |   |   |   |   |       |
| 337 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |        |                                                     |   |   |   |   |   |   |       |
| 338 | 95% CLT UCL                                                                                                                              |   | 5.148  | 95% Jackknife UCL                                   |   |   |   |   |   |   | 5.152 |
| 339 | 95% Standard Bootstrap UCL                                                                                                               |   | 5.157  | 95% Bootstrap-t UCL                                 |   |   |   |   |   |   | 5.208 |
| 340 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 5.257  | 95% Percentile Bootstrap UCL                        |   |   |   |   |   |   | 5.153 |
| 341 | 95% BCA Bootstrap UCL                                                                                                                    |   | 5.19   |                                                     |   |   |   |   |   |   |       |
| 342 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 5.45   | 95% Chebyshev(Mean, Sd) UCL                         |   |   |   |   |   |   | 5.752 |
| 343 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 6.172  | 99% Chebyshev(Mean, Sd) UCL                         |   |   |   |   |   |   | 6.996 |
| 344 |                                                                                                                                          |   |        |                                                     |   |   |   |   |   |   |       |
| 345 | <b>Suggested UCL to Use</b>                                                                                                              |   |        |                                                     |   |   |   |   |   |   |       |
| 346 | 95% Approximate Gamma UCL                                                                                                                |   | 5.139  |                                                     |   |   |   |   |   |   |       |
| 347 |                                                                                                                                          |   |        |                                                     |   |   |   |   |   |   |       |
| 348 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |                                                     |   |   |   |   |   |   |       |
| 349 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |                                                     |   |   |   |   |   |   |       |
| 350 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |                                                     |   |   |   |   |   |   |       |
| 351 | However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |   |        |                                                     |   |   |   |   |   |   |       |
| 352 |                                                                                                                                          |   |        |                                                     |   |   |   |   |   |   |       |
| 353 |                                                                                                                                          |   |        |                                                     |   |   |   |   |   |   |       |
| 354 | <b>Result (eu5b_cobalt_soil-road)</b>                                                                                                    |   |        |                                                     |   |   |   |   |   |   |       |
| 355 |                                                                                                                                          |   |        |                                                     |   |   |   |   |   |   |       |
| 356 | <b>General Statistics</b>                                                                                                                |   |        |                                                     |   |   |   |   |   |   |       |
| 357 | Total Number of Observations                                                                                                             |   | 85     | Number of Distinct Observations                     |   |   |   |   |   |   | 63    |
| 358 |                                                                                                                                          |   |        | Number of Missing Observations                      |   |   |   |   |   |   | 0     |
| 359 | Minimum                                                                                                                                  |   | 1.5    | Mean                                                |   |   |   |   |   |   | 7.787 |
| 360 | Maximum                                                                                                                                  |   | 43.6   | Median                                              |   |   |   |   |   |   | 6.4   |
| 361 | SD                                                                                                                                       |   | 5.837  | Std. Error of Mean                                  |   |   |   |   |   |   | 0.633 |
| 362 | Coefficient of Variation                                                                                                                 |   | 0.75   | Skewness                                            |   |   |   |   |   |   | 3.569 |
| 363 |                                                                                                                                          |   |        |                                                     |   |   |   |   |   |   |       |
| 364 | <b>Normal GOF Test</b>                                                                                                                   |   |        |                                                     |   |   |   |   |   |   |       |
| 365 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.678  | <b>Shapiro Wilk GOF Test</b>                        |   |   |   |   |   |   |       |
| 366 | 5% Shapiro Wilk P Value                                                                                                                  |   | 0      | Data Not Normal at 5% Significance Level            |   |   |   |   |   |   |       |
| 367 | Lilliefors Test Statistic                                                                                                                |   | 0.243  | <b>Lilliefors GOF Test</b>                          |   |   |   |   |   |   |       |
| 368 | 5% Lilliefors Critical Value                                                                                                             |   | 0.0962 | Data Not Normal at 5% Significance Level            |   |   |   |   |   |   |       |
| 369 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |        |                                                     |   |   |   |   |   |   |       |
| 370 |                                                                                                                                          |   |        |                                                     |   |   |   |   |   |   |       |
| 371 | <b>Assuming Normal Distribution</b>                                                                                                      |   |        |                                                     |   |   |   |   |   |   |       |
| 372 | <b>95% Normal UCL</b>                                                                                                                    |   |        | <b>95% UCLs (Adjusted for Skewness)</b>             |   |   |   |   |   |   |       |
| 373 | 95% Student's-t UCL                                                                                                                      |   | 8.84   | 95% Adjusted-CLT UCL (Chen-1995)                    |   |   |   |   |   |   | 9.09  |
| 374 |                                                                                                                                          |   |        | 95% Modified-t UCL (Johnson-1978)                   |   |   |   |   |   |   | 8.881 |
| 375 |                                                                                                                                          |   |        |                                                     |   |   |   |   |   |   |       |
| 376 | <b>Gamma GOF Test</b>                                                                                                                    |   |        |                                                     |   |   |   |   |   |   |       |
| 377 | A-D Test Statistic                                                                                                                       |   | 2.49   | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |   |   |   |   |       |
| 378 | 5% A-D Critical Value                                                                                                                    |   | 0.759  | Data Not Gamma Distributed at 5% Significance Level |   |   |   |   |   |   |       |
| 379 | K-S Test Statistic                                                                                                                       |   | 0.163  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |   |   |   |   |       |
| 380 | 5% K-S Critical Value                                                                                                                    |   | 0.0976 | Data Not Gamma Distributed at 5% Significance Level |   |   |   |   |   |   |       |
| 381 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |        |                                                     |   |   |   |   |   |   |       |
| 382 |                                                                                                                                          |   |        |                                                     |   |   |   |   |   |   |       |
| 383 | <b>Gamma Statistics</b>                                                                                                                  |   |        |                                                     |   |   |   |   |   |   |       |
| 384 | k hat (MLE)                                                                                                                              |   | 3.15   | k star (bias corrected MLE)                         |   |   |   |   |   |   | 3.046 |
| 385 | Theta hat (MLE)                                                                                                                          |   | 2.472  | Theta star (bias corrected MLE)                     |   |   |   |   |   |   | 2.556 |
| 386 | nu hat (MLE)                                                                                                                             |   | 535.4  | nu star (bias corrected)                            |   |   |   |   |   |   | 517.9 |
| 387 | MLE Mean (bias corrected)                                                                                                                |   | 7.787  | MLE Sd (bias corrected)                             |   |   |   |   |   |   | 4.461 |
| 388 |                                                                                                                                          |   |        | Approximate Chi Square Value (0.05)                 |   |   |   |   |   |   | 466.1 |
| 389 | Adjusted Level of Significance                                                                                                           |   | 0.0472 | Adjusted Chi Square Value                           |   |   |   |   |   |   | 465.3 |
| 390 |                                                                                                                                          |   |        |                                                     |   |   |   |   |   |   |       |
| 391 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |        |                                                     |   |   |   |   |   |   |       |
| 392 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   | 8.652  | 95% Adjusted Gamma UCL (use when n<50)              |   |   |   |   |   |   | 8.667 |
| 393 |                                                                                                                                          |   |        |                                                     |   |   |   |   |   |   |       |
| 394 | <b>Lognormal GOF Test</b>                                                                                                                |   |        |                                                     |   |   |   |   |   |   |       |
| 395 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.967  | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |   |   |   |   |   |       |
| 396 | 5% Shapiro Wilk P Value                                                                                                                  |   | 0.126  | Data appear Lognormal at 5% Significance Level      |   |   |   |   |   |   |       |
| 397 | Lilliefors Test Statistic                                                                                                                |   | 0.117  | <b>Lilliefors Lognormal GOF Test</b>                |   |   |   |   |   |   |       |
| 398 | 5% Lilliefors Critical Value                                                                                                             |   | 0.0962 | Data Not Lognormal at 5% Significance Level         |   |   |   |   |   |   |       |
| 399 | <b>Data appear Approximate Lognormal at 5% Significance Level</b>                                                                        |   |        |                                                     |   |   |   |   |   |   |       |
| 400 |                                                                                                                                          |   |        |                                                     |   |   |   |   |   |   |       |
| 401 | <b>Lognormal Statistics</b>                                                                                                              |   |        |                                                     |   |   |   |   |   |   |       |
| 402 | Minimum of Logged Data                                                                                                                   |   | 0.405  | Mean of logged Data                                 |   |   |   |   |   |   | 1.885 |

| A   | B                                                                                                                                         | C | E      | F                                                   | G     | H                 | I | J | K | L     |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------|---|--------|-----------------------------------------------------|-------|-------------------|---|---|---|-------|
| 403 | Maximum of Logged Data                                                                                                                    |   |        |                                                     | 3.775 | SD of logged Data |   |   |   | 0.546 |
| 404 |                                                                                                                                           |   |        |                                                     |       |                   |   |   |   |       |
| 405 | <b>Assuming Lognormal Distribution</b>                                                                                                    |   |        |                                                     |       |                   |   |   |   |       |
| 406 | 95% H-UCL                                                                                                                                 |   | 8.551  | 90% Chebyshev (MVUE) UCL                            |       | 9.076             |   |   |   |       |
| 407 | 95% Chebyshev (MVUE) UCL                                                                                                                  |   | 9.73   | 97.5% Chebyshev (MVUE) UCL                          |       | 10.64             |   |   |   |       |
| 408 | 99% Chebyshev (MVUE) UCL                                                                                                                  |   | 12.42  |                                                     |       |                   |   |   |   |       |
| 409 |                                                                                                                                           |   |        |                                                     |       |                   |   |   |   |       |
| 410 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                     |   |        |                                                     |       |                   |   |   |   |       |
| 411 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                          |   |        |                                                     |       |                   |   |   |   |       |
| 412 |                                                                                                                                           |   |        |                                                     |       |                   |   |   |   |       |
| 413 | <b>Nonparametric Distribution Free UCLs</b>                                                                                               |   |        |                                                     |       |                   |   |   |   |       |
| 414 | 95% CLT UCL                                                                                                                               |   | 8.828  | 95% Jackknife UCL                                   |       | 8.84              |   |   |   |       |
| 415 | 95% Standard Bootstrap UCL                                                                                                                |   | 8.815  | 95% Bootstrap-t UCL                                 |       | 9.366             |   |   |   |       |
| 416 | 95% Hall's Bootstrap UCL                                                                                                                  |   | 9.671  | 95% Percentile Bootstrap UCL                        |       | 8.878             |   |   |   |       |
| 417 | 95% BCA Bootstrap UCL                                                                                                                     |   | 8.996  |                                                     |       |                   |   |   |   |       |
| 418 | 90% Chebyshev(Mean, Sd) UCL                                                                                                               |   | 9.686  | 95% Chebyshev(Mean, Sd) UCL                         |       | 10.55             |   |   |   |       |
| 419 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                             |   | 11.74  | 99% Chebyshev(Mean, Sd) UCL                         |       | 14.09             |   |   |   |       |
| 420 |                                                                                                                                           |   |        |                                                     |       |                   |   |   |   |       |
| 421 | <b>Suggested UCL to Use</b>                                                                                                               |   |        |                                                     |       |                   |   |   |   |       |
| 422 | 95% H-UCL                                                                                                                                 |   | 8.551  |                                                     |       |                   |   |   |   |       |
| 423 |                                                                                                                                           |   |        |                                                     |       |                   |   |   |   |       |
| 424 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |   |        |                                                     |       |                   |   |   |   |       |
| 425 | Recommendations are based upon data size, data distribution, and skewness.                                                                |   |        |                                                     |       |                   |   |   |   |       |
| 426 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |   |        |                                                     |       |                   |   |   |   |       |
| 427 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |   |        |                                                     |       |                   |   |   |   |       |
| 428 |                                                                                                                                           |   |        |                                                     |       |                   |   |   |   |       |
| 429 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                    |   |        |                                                     |       |                   |   |   |   |       |
| 430 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>             |   |        |                                                     |       |                   |   |   |   |       |
| 431 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                        |   |        |                                                     |       |                   |   |   |   |       |
| 432 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>         |   |        |                                                     |       |                   |   |   |   |       |
| 433 |                                                                                                                                           |   |        |                                                     |       |                   |   |   |   |       |
| 434 |                                                                                                                                           |   |        |                                                     |       |                   |   |   |   |       |
| 435 | <b>Result (eu5b_iron_soil-road)</b>                                                                                                       |   |        |                                                     |       |                   |   |   |   |       |
| 436 |                                                                                                                                           |   |        |                                                     |       |                   |   |   |   |       |
| 437 | <b>General Statistics</b>                                                                                                                 |   |        |                                                     |       |                   |   |   |   |       |
| 438 | Total Number of Observations                                                                                                              |   | 85     | Number of Distinct Observations                     |       | 74                |   |   |   |       |
| 439 |                                                                                                                                           |   |        | Number of Missing Observations                      |       | 0                 |   |   |   |       |
| 440 | Minimum                                                                                                                                   |   | 10400  | Mean                                                |       | 28131             |   |   |   |       |
| 441 | Maximum                                                                                                                                   |   | 175000 | Median                                              |       | 24500             |   |   |   |       |
| 442 | SD                                                                                                                                        |   | 19068  | Std. Error of Mean                                  |       | 2068              |   |   |   |       |
| 443 | Coefficient of Variation                                                                                                                  |   | 0.678  | Skewness                                            |       | 5.789             |   |   |   |       |
| 444 |                                                                                                                                           |   |        |                                                     |       |                   |   |   |   |       |
| 445 | <b>Normal GOF Test</b>                                                                                                                    |   |        |                                                     |       |                   |   |   |   |       |
| 446 | Shapiro Wilk Test Statistic                                                                                                               |   | 0.532  | <b>Shapiro Wilk GOF Test</b>                        |       |                   |   |   |   |       |
| 447 | 5% Shapiro Wilk P Value                                                                                                                   |   | 0      | Data Not Normal at 5% Significance Level            |       |                   |   |   |   |       |
| 448 | Lilliefors Test Statistic                                                                                                                 |   | 0.265  | <b>Lilliefors GOF Test</b>                          |       |                   |   |   |   |       |
| 449 | 5% Lilliefors Critical Value                                                                                                              |   | 0.0962 | Data Not Normal at 5% Significance Level            |       |                   |   |   |   |       |
| 450 | <b>Data Not Normal at 5% Significance Level</b>                                                                                           |   |        |                                                     |       |                   |   |   |   |       |
| 451 |                                                                                                                                           |   |        |                                                     |       |                   |   |   |   |       |
| 452 | <b>Assuming Normal Distribution</b>                                                                                                       |   |        |                                                     |       |                   |   |   |   |       |
| 453 | <b>95% Normal UCL</b>                                                                                                                     |   |        | <b>95% UCLs (Adjusted for Skewness)</b>             |       |                   |   |   |   |       |
| 454 | 95% Student's-t UCL                                                                                                                       |   | 31570  | 95% Adjusted-CLT UCL (Chen-1995)                    |       | 32920             |   |   |   |       |
| 455 |                                                                                                                                           |   |        | 95% Modified-t UCL (Johnson-1978)                   |       | 31787             |   |   |   |       |
| 456 |                                                                                                                                           |   |        |                                                     |       |                   |   |   |   |       |
| 457 | <b>Gamma GOF Test</b>                                                                                                                     |   |        |                                                     |       |                   |   |   |   |       |
| 458 | A-D Test Statistic                                                                                                                        |   | 3.502  | <b>Anderson-Darling Gamma GOF Test</b>              |       |                   |   |   |   |       |
| 459 | 5% A-D Critical Value                                                                                                                     |   | 0.755  | Data Not Gamma Distributed at 5% Significance Level |       |                   |   |   |   |       |
| 460 | K-S Test Statistic                                                                                                                        |   | 0.181  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |       |                   |   |   |   |       |
| 461 | 5% K-S Critical Value                                                                                                                     |   | 0.0972 | Data Not Gamma Distributed at 5% Significance Level |       |                   |   |   |   |       |
| 462 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                                |   |        |                                                     |       |                   |   |   |   |       |
| 463 |                                                                                                                                           |   |        |                                                     |       |                   |   |   |   |       |
| 464 | <b>Gamma Statistics</b>                                                                                                                   |   |        |                                                     |       |                   |   |   |   |       |
| 465 | k hat (MLE)                                                                                                                               |   | 5.01   | k star (bias corrected MLE)                         |       | 4.841             |   |   |   |       |
| 466 | Theta hat (MLE)                                                                                                                           |   | 5614   | Theta star (bias corrected MLE)                     |       | 5810              |   |   |   |       |
| 467 | nu hat (MLE)                                                                                                                              |   | 851.8  | nu star (bias corrected)                            |       | 823               |   |   |   |       |
| 468 | MLE Mean (bias corrected)                                                                                                                 |   | 28131  | MLE Sd (bias corrected)                             |       | 12785             |   |   |   |       |
| 469 |                                                                                                                                           |   |        | Approximate Chi Square Value (0.05)                 |       | 757.5             |   |   |   |       |

|     |                                                                                                                                           |           |                                                     |       |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------------------------------------------------|-------|
| 470 | Adjusted Level of Significance                                                                                                            | 0.0472    | Adjusted Chi Square Value                           | 756.4 |
| 471 |                                                                                                                                           |           |                                                     |       |
| 472 | <b>Assuming Gamma Distribution</b>                                                                                                        |           |                                                     |       |
| 473 | 95% Approximate Gamma UCL (use when n>=50))                                                                                               | 30566     | 95% Adjusted Gamma UCL (use when n<50)              | 30609 |
| 474 |                                                                                                                                           |           |                                                     |       |
| 475 | <b>Lognormal GOF Test</b>                                                                                                                 |           |                                                     |       |
| 476 | Shapiro Wilk Test Statistic                                                                                                               | 0.919     | <b>Shapiro Wilk Lognormal GOF Test</b>              |       |
| 477 | 5% Shapiro Wilk P Value                                                                                                                   | 1.3121E-5 | Data Not Lognormal at 5% Significance Level         |       |
| 478 | Lilliefors Test Statistic                                                                                                                 | 0.136     | <b>Lilliefors Lognormal GOF Test</b>                |       |
| 479 | 5% Lilliefors Critical Value                                                                                                              | 0.0962    | Data Not Lognormal at 5% Significance Level         |       |
| 480 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                        |           |                                                     |       |
| 481 |                                                                                                                                           |           |                                                     |       |
| 482 | <b>Lognormal Statistics</b>                                                                                                               |           |                                                     |       |
| 483 | Minimum of Logged Data                                                                                                                    | 9.25      | Mean of logged Data                                 | 10.14 |
| 484 | Maximum of Logged Data                                                                                                                    | 12.07     | SD of logged Data                                   | 0.404 |
| 485 |                                                                                                                                           |           |                                                     |       |
| 486 | <b>Assuming Lognormal Distribution</b>                                                                                                    |           |                                                     |       |
| 487 | 95% H-UCL                                                                                                                                 | 29797     | 90% Chebyshev (MVUE) UCL                            | 31253 |
| 488 | 95% Chebyshev (MVUE) UCL                                                                                                                  | 32951     | 97.5% Chebyshev (MVUE) UCL                          | 35307 |
| 489 | 99% Chebyshev (MVUE) UCL                                                                                                                  | 39935     |                                                     |       |
| 490 |                                                                                                                                           |           |                                                     |       |
| 491 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                     |           |                                                     |       |
| 492 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                               |           |                                                     |       |
| 493 |                                                                                                                                           |           |                                                     |       |
| 494 | <b>Nonparametric Distribution Free UCLs</b>                                                                                               |           |                                                     |       |
| 495 | 95% CLT UCL                                                                                                                               | 31533     | 95% Jackknife UCL                                   | 31570 |
| 496 | 95% Standard Bootstrap UCL                                                                                                                | 31507     | 95% Bootstrap-t UCL                                 | 34819 |
| 497 | 95% Hall's Bootstrap UCL                                                                                                                  | 46717     | 95% Percentile Bootstrap UCL                        | 31867 |
| 498 | 95% BCA Bootstrap UCL                                                                                                                     | 33529     |                                                     |       |
| 499 | 90% Chebyshev(Mean, Sd) UCL                                                                                                               | 34335     | 95% Chebyshev(Mean, Sd) UCL                         | 37146 |
| 500 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                             | 41047     | 99% Chebyshev(Mean, Sd) UCL                         | 48709 |
| 501 |                                                                                                                                           |           |                                                     |       |
| 502 | <b>Suggested UCL to Use</b>                                                                                                               |           |                                                     |       |
| 503 | 95% Student's-t UCL                                                                                                                       | 31570     | or 95% Modified-t UCL                               | 31787 |
| 504 |                                                                                                                                           |           |                                                     |       |
| 505 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |           |                                                     |       |
| 506 | Recommendations are based upon data size, data distribution, and skewness.                                                                |           |                                                     |       |
| 507 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |           |                                                     |       |
| 508 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |           |                                                     |       |
| 509 |                                                                                                                                           |           |                                                     |       |
| 510 |                                                                                                                                           |           |                                                     |       |
| 511 | <b>Result (eu5b_lead_soil-road)</b>                                                                                                       |           |                                                     |       |
| 512 |                                                                                                                                           |           |                                                     |       |
| 513 | <b>General Statistics</b>                                                                                                                 |           |                                                     |       |
| 514 | Total Number of Observations                                                                                                              | 85        | Number of Distinct Observations                     | 83    |
| 515 |                                                                                                                                           |           | Number of Missing Observations                      | 0     |
| 516 | Minimum                                                                                                                                   | 13.7      | Mean                                                | 1228  |
| 517 | Maximum                                                                                                                                   | 18300     | Median                                              | 344   |
| 518 | SD                                                                                                                                        | 2852      | Std. Error of Mean                                  | 309.3 |
| 519 | Coefficient of Variation                                                                                                                  | 2.322     | Skewness                                            | 4.206 |
| 520 |                                                                                                                                           |           |                                                     |       |
| 521 | <b>Normal GOF Test</b>                                                                                                                    |           |                                                     |       |
| 522 | Shapiro Wilk Test Statistic                                                                                                               | 0.448     | <b>Shapiro Wilk GOF Test</b>                        |       |
| 523 | 5% Shapiro Wilk P Value                                                                                                                   | 0         | Data Not Normal at 5% Significance Level            |       |
| 524 | Lilliefors Test Statistic                                                                                                                 | 0.335     | <b>Lilliefors GOF Test</b>                          |       |
| 525 | 5% Lilliefors Critical Value                                                                                                              | 0.0962    | Data Not Normal at 5% Significance Level            |       |
| 526 | <b>Data Not Normal at 5% Significance Level</b>                                                                                           |           |                                                     |       |
| 527 |                                                                                                                                           |           |                                                     |       |
| 528 | <b>Assuming Normal Distribution</b>                                                                                                       |           |                                                     |       |
| 529 | <b>95% Normal UCL</b>                                                                                                                     |           | <b>95% UCLs (Adjusted for Skewness)</b>             |       |
| 530 | 95% Student's-t UCL                                                                                                                       | 1742      | 95% Adjusted-CLT UCL (Chen-1995)                    | 1887  |
| 531 |                                                                                                                                           |           | 95% Modified-t UCL (Johnson-1978)                   | 1766  |
| 532 |                                                                                                                                           |           |                                                     |       |
| 533 | <b>Gamma GOF Test</b>                                                                                                                     |           |                                                     |       |
| 534 | A-D Test Statistic                                                                                                                        | 4.996     | <b>Anderson-Darling Gamma GOF Test</b>              |       |
| 535 | 5% A-D Critical Value                                                                                                                     | 0.817     | Data Not Gamma Distributed at 5% Significance Level |       |
| 536 | K-S Test Statistic                                                                                                                        | 0.211     | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |       |

|     |                                                                                                                                           |                       |                                                |                                                     |  |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------------------------------------------------|-----------------------------------------------------|--|
| 537 |                                                                                                                                           | 5% K-S Critical Value | 0.102                                          | Data Not Gamma Distributed at 5% Significance Level |  |
| 538 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                                |                       |                                                |                                                     |  |
| 539 |                                                                                                                                           |                       |                                                |                                                     |  |
| 540 | <b>Gamma Statistics</b>                                                                                                                   |                       |                                                |                                                     |  |
| 541 | k hat (MLE)                                                                                                                               | 0.516                 | k star (bias corrected MLE)                    | 0.506                                               |  |
| 542 | Theta hat (MLE)                                                                                                                           | 2378                  | Theta star (bias corrected MLE)                | 2427                                                |  |
| 543 | nu hat (MLE)                                                                                                                              | 87.77                 | nu star (bias corrected)                       | 86                                                  |  |
| 544 | MLE Mean (bias corrected)                                                                                                                 | 1228                  | MLE Sd (bias corrected)                        | 1726                                                |  |
| 545 |                                                                                                                                           |                       | Approximate Chi Square Value (0.05)            | 65.63                                               |  |
| 546 | Adjusted Level of Significance                                                                                                            | 0.0472                | Adjusted Chi Square Value                      | 65.32                                               |  |
| 547 |                                                                                                                                           |                       |                                                |                                                     |  |
| 548 | <b>Assuming Gamma Distribution</b>                                                                                                        |                       |                                                |                                                     |  |
| 549 | 95% Approximate Gamma UCL (use when n>=50))                                                                                               | 1609                  | 95% Adjusted Gamma UCL (use when n<50)         | 1617                                                |  |
| 550 |                                                                                                                                           |                       |                                                |                                                     |  |
| 551 | <b>Lognormal GOF Test</b>                                                                                                                 |                       |                                                |                                                     |  |
| 552 | Shapiro Wilk Test Statistic                                                                                                               | 0.971                 | <b>Shapiro Wilk Lognormal GOF Test</b>         |                                                     |  |
| 553 | 5% Shapiro Wilk P Value                                                                                                                   | 0.205                 | Data appear Lognormal at 5% Significance Level |                                                     |  |
| 554 | Lilliefors Test Statistic                                                                                                                 | 0.0813                | <b>Lilliefors Lognormal GOF Test</b>           |                                                     |  |
| 555 | 5% Lilliefors Critical Value                                                                                                              | 0.0962                | Data appear Lognormal at 5% Significance Level |                                                     |  |
| 556 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                     |                       |                                                |                                                     |  |
| 557 |                                                                                                                                           |                       |                                                |                                                     |  |
| 558 | <b>Lognormal Statistics</b>                                                                                                               |                       |                                                |                                                     |  |
| 559 | Minimum of Logged Data                                                                                                                    | 2.617                 | Mean of logged Data                            | 5.889                                               |  |
| 560 | Maximum of Logged Data                                                                                                                    | 9.815                 | SD of logged Data                              | 1.469                                               |  |
| 561 |                                                                                                                                           |                       |                                                |                                                     |  |
| 562 | <b>Assuming Lognormal Distribution</b>                                                                                                    |                       |                                                |                                                     |  |
| 563 | 95% H-UCL                                                                                                                                 | 1646                  | 90% Chebyshev (MVUE) UCL                       | 1711                                                |  |
| 564 | 95% Chebyshev (MVUE) UCL                                                                                                                  | 2017                  | 97.5% Chebyshev (MVUE) UCL                     | 2442                                                |  |
| 565 | 99% Chebyshev (MVUE) UCL                                                                                                                  | 3276                  |                                                |                                                     |  |
| 566 |                                                                                                                                           |                       |                                                |                                                     |  |
| 567 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                     |                       |                                                |                                                     |  |
| 568 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                          |                       |                                                |                                                     |  |
| 569 |                                                                                                                                           |                       |                                                |                                                     |  |
| 570 | <b>Nonparametric Distribution Free UCLs</b>                                                                                               |                       |                                                |                                                     |  |
| 571 | 95% CLT UCL                                                                                                                               | 1737                  | 95% Jackknife UCL                              | 1742                                                |  |
| 572 | 95% Standard Bootstrap UCL                                                                                                                | 1739                  | 95% Bootstrap-t UCL                            | 2029                                                |  |
| 573 | 95% Hall's Bootstrap UCL                                                                                                                  | 2006                  | 95% Percentile Bootstrap UCL                   | 1778                                                |  |
| 574 | 95% BCA Bootstrap UCL                                                                                                                     | 1891                  |                                                |                                                     |  |
| 575 | 90% Chebyshev(Mean, Sd) UCL                                                                                                               | 2156                  | 95% Chebyshev(Mean, Sd) UCL                    | 2576                                                |  |
| 576 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                             | 3159                  | 99% Chebyshev(Mean, Sd) UCL                    | 4305                                                |  |
| 577 |                                                                                                                                           |                       |                                                |                                                     |  |
| 578 | <b>Suggested UCL to Use</b>                                                                                                               |                       |                                                |                                                     |  |
| 579 | 95% H-UCL                                                                                                                                 | 1646                  |                                                |                                                     |  |
| 580 |                                                                                                                                           |                       |                                                |                                                     |  |
| 581 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |                       |                                                |                                                     |  |
| 582 | Recommendations are based upon data size, data distribution, and skewness.                                                                |                       |                                                |                                                     |  |
| 583 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |                       |                                                |                                                     |  |
| 584 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |                       |                                                |                                                     |  |
| 585 |                                                                                                                                           |                       |                                                |                                                     |  |
| 586 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                    |                       |                                                |                                                     |  |
| 587 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>             |                       |                                                |                                                     |  |
| 588 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                        |                       |                                                |                                                     |  |
| 589 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>         |                       |                                                |                                                     |  |
| 590 |                                                                                                                                           |                       |                                                |                                                     |  |
| 591 |                                                                                                                                           |                       |                                                |                                                     |  |
| 592 | <b>Result (eu5b_manganese_soil-road)</b>                                                                                                  |                       |                                                |                                                     |  |
| 593 |                                                                                                                                           |                       |                                                |                                                     |  |
| 594 | <b>General Statistics</b>                                                                                                                 |                       |                                                |                                                     |  |
| 595 | Total Number of Observations                                                                                                              | 85                    | Number of Distinct Observations                | 79                                                  |  |
| 596 |                                                                                                                                           |                       | Number of Missing Observations                 | 0                                                   |  |
| 597 | Minimum                                                                                                                                   | 182                   | Mean                                           | 2382                                                |  |
| 598 | Maximum                                                                                                                                   | 27800                 | Median                                         | 1180                                                |  |
| 599 | SD                                                                                                                                        | 4329                  | Std. Error of Mean                             | 469.6                                               |  |
| 600 | Coefficient of Variation                                                                                                                  | 1.818                 | Skewness                                       | 4.809                                               |  |
| 601 |                                                                                                                                           |                       |                                                |                                                     |  |
| 602 | <b>Normal GOF Test</b>                                                                                                                    |                       |                                                |                                                     |  |
| 603 | Shapiro Wilk Test Statistic                                                                                                               | 0.432                 | <b>Shapiro Wilk GOF Test</b>                   |                                                     |  |

| A   | B | C | D                                                                                                                                        | E       | F | G                                                   | H                                       | I | J | K     | L |
|-----|---|---|------------------------------------------------------------------------------------------------------------------------------------------|---------|---|-----------------------------------------------------|-----------------------------------------|---|---|-------|---|
| 604 |   |   | 5% Shapiro Wilk P Value                                                                                                                  | 0       |   | Data Not Normal at 5% Significance Level            |                                         |   |   |       |   |
| 605 |   |   | Lilliefors Test Statistic                                                                                                                | 0.307   |   | <b>Lilliefors GOF Test</b>                          |                                         |   |   |       |   |
| 606 |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.0962  |   | Data Not Normal at 5% Significance Level            |                                         |   |   |       |   |
| 607 |   |   | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |         |   |                                                     |                                         |   |   |       |   |
| 608 |   |   |                                                                                                                                          |         |   |                                                     |                                         |   |   |       |   |
| 609 |   |   | <b>Assuming Normal Distribution</b>                                                                                                      |         |   |                                                     |                                         |   |   |       |   |
| 610 |   |   | <b>95% Normal UCL</b>                                                                                                                    |         |   |                                                     | <b>95% UCLs (Adjusted for Skewness)</b> |   |   |       |   |
| 611 |   |   | 95% Student's-t UCL                                                                                                                      | 3163    |   | 95% Adjusted-CLT UCL (Chen-1995)                    |                                         |   |   | 3416  |   |
| 612 |   |   |                                                                                                                                          |         |   | 95% Modified-t UCL (Johnson-1978)                   |                                         |   |   | 3204  |   |
| 613 |   |   |                                                                                                                                          |         |   |                                                     |                                         |   |   |       |   |
| 614 |   |   | <b>Gamma GOF Test</b>                                                                                                                    |         |   |                                                     |                                         |   |   |       |   |
| 615 |   |   | A-D Test Statistic                                                                                                                       | 5.162   |   | <b>Anderson-Darling Gamma GOF Test</b>              |                                         |   |   |       |   |
| 616 |   |   | 5% A-D Critical Value                                                                                                                    | 0.782   |   | Data Not Gamma Distributed at 5% Significance Level |                                         |   |   |       |   |
| 617 |   |   | K-S Test Statistic                                                                                                                       | 0.191   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |                                         |   |   |       |   |
| 618 |   |   | 5% K-S Critical Value                                                                                                                    | 0.0998  |   | Data Not Gamma Distributed at 5% Significance Level |                                         |   |   |       |   |
| 619 |   |   | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |         |   |                                                     |                                         |   |   |       |   |
| 620 |   |   |                                                                                                                                          |         |   |                                                     |                                         |   |   |       |   |
| 621 |   |   | <b>Gamma Statistics</b>                                                                                                                  |         |   |                                                     |                                         |   |   |       |   |
| 622 |   |   | k hat (MLE)                                                                                                                              | 1.011   |   | k star (bias corrected MLE)                         |                                         |   |   | 0.984 |   |
| 623 |   |   | Theta hat (MLE)                                                                                                                          | 2355    |   | Theta star (bias corrected MLE)                     |                                         |   |   | 2422  |   |
| 624 |   |   | nu hat (MLE)                                                                                                                             | 172     |   | nu star (bias corrected)                            |                                         |   |   | 167.2 |   |
| 625 |   |   | MLE Mean (bias corrected)                                                                                                                | 2382    |   | MLE Sd (bias corrected)                             |                                         |   |   | 2402  |   |
| 626 |   |   |                                                                                                                                          |         |   | Approximate Chi Square Value (0.05)                 |                                         |   |   | 138.3 |   |
| 627 |   |   | Adjusted Level of Significance                                                                                                           | 0.0472  |   | Adjusted Chi Square Value                           |                                         |   |   | 137.9 |   |
| 628 |   |   |                                                                                                                                          |         |   |                                                     |                                         |   |   |       |   |
| 629 |   |   | <b>Assuming Gamma Distribution</b>                                                                                                       |         |   |                                                     |                                         |   |   |       |   |
| 630 |   |   | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | 2880    |   | 95% Adjusted Gamma UCL (use when n<50)              |                                         |   |   | 2889  |   |
| 631 |   |   |                                                                                                                                          |         |   |                                                     |                                         |   |   |       |   |
| 632 |   |   | <b>Lognormal GOF Test</b>                                                                                                                |         |   |                                                     |                                         |   |   |       |   |
| 633 |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.945   |   | <b>Shapiro Wilk Lognormal GOF Test</b>              |                                         |   |   |       |   |
| 634 |   |   | 5% Shapiro Wilk P Value                                                                                                                  | 0.00254 |   | Data Not Lognormal at 5% Significance Level         |                                         |   |   |       |   |
| 635 |   |   | Lilliefors Test Statistic                                                                                                                | 0.104   |   | <b>Lilliefors Lognormal GOF Test</b>                |                                         |   |   |       |   |
| 636 |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.0962  |   | Data Not Lognormal at 5% Significance Level         |                                         |   |   |       |   |
| 637 |   |   | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |         |   |                                                     |                                         |   |   |       |   |
| 638 |   |   |                                                                                                                                          |         |   |                                                     |                                         |   |   |       |   |
| 639 |   |   | <b>Lognormal Statistics</b>                                                                                                              |         |   |                                                     |                                         |   |   |       |   |
| 640 |   |   | Minimum of Logged Data                                                                                                                   | 5.204   |   | Mean of logged Data                                 |                                         |   |   | 7.206 |   |
| 641 |   |   | Maximum of Logged Data                                                                                                                   | 10.23   |   | SD of logged Data                                   |                                         |   |   | 0.919 |   |
| 642 |   |   |                                                                                                                                          |         |   |                                                     |                                         |   |   |       |   |
| 643 |   |   | <b>Assuming Lognormal Distribution</b>                                                                                                   |         |   |                                                     |                                         |   |   |       |   |
| 644 |   |   | 95% H-UCL                                                                                                                                | 2554    |   | 90% Chebyshev (MVUE) UCL                            |                                         |   |   | 2755  |   |
| 645 |   |   | 95% Chebyshev (MVUE) UCL                                                                                                                 | 3078    |   | 97.5% Chebyshev (MVUE) UCL                          |                                         |   |   | 3527  |   |
| 646 |   |   | 99% Chebyshev (MVUE) UCL                                                                                                                 | 4408    |   |                                                     |                                         |   |   |       |   |
| 647 |   |   |                                                                                                                                          |         |   |                                                     |                                         |   |   |       |   |
| 648 |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |         |   |                                                     |                                         |   |   |       |   |
| 649 |   |   | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |         |   |                                                     |                                         |   |   |       |   |
| 650 |   |   |                                                                                                                                          |         |   |                                                     |                                         |   |   |       |   |
| 651 |   |   | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |         |   |                                                     |                                         |   |   |       |   |
| 652 |   |   | 95% CLT UCL                                                                                                                              | 3154    |   | 95% Jackknife UCL                                   |                                         |   |   | 3163  |   |
| 653 |   |   | 95% Standard Bootstrap UCL                                                                                                               | 3169    |   | 95% Bootstrap-t UCL                                 |                                         |   |   | 4173  |   |
| 654 |   |   | 95% Hall's Bootstrap UCL                                                                                                                 | 6568    |   | 95% Percentile Bootstrap UCL                        |                                         |   |   | 3212  |   |
| 655 |   |   | 95% BCA Bootstrap UCL                                                                                                                    | 3401    |   |                                                     |                                         |   |   |       |   |
| 656 |   |   | 90% Chebyshev(Mean, Sd) UCL                                                                                                              | 3791    |   | 95% Chebyshev(Mean, Sd) UCL                         |                                         |   |   | 4429  |   |
| 657 |   |   | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            | 5314    |   | 99% Chebyshev(Mean, Sd) UCL                         |                                         |   |   | 7054  |   |
| 658 |   |   |                                                                                                                                          |         |   |                                                     |                                         |   |   |       |   |
| 659 |   |   | <b>Suggested UCL to Use</b>                                                                                                              |         |   |                                                     |                                         |   |   |       |   |
| 660 |   |   | 95% Chebyshev (Mean, Sd) UCL                                                                                                             | 4429    |   |                                                     |                                         |   |   |       |   |
| 661 |   |   |                                                                                                                                          |         |   |                                                     |                                         |   |   |       |   |
| 662 |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |         |   |                                                     |                                         |   |   |       |   |
| 663 |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |         |   |                                                     |                                         |   |   |       |   |
| 664 |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |         |   |                                                     |                                         |   |   |       |   |
| 665 |   |   | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |         |   |                                                     |                                         |   |   |       |   |
| 666 |   |   |                                                                                                                                          |         |   |                                                     |                                         |   |   |       |   |
| 667 |   |   | <b>Result (eu5b_thallium_soil-road)</b>                                                                                                  |         |   |                                                     |                                         |   |   |       |   |
| 668 |   |   |                                                                                                                                          |         |   |                                                     |                                         |   |   |       |   |
| 669 |   |   | <b>General Statistics</b>                                                                                                                |         |   |                                                     |                                         |   |   |       |   |
| 670 |   |   | Total Number of Observations                                                                                                             | 84      |   | Number of Distinct Observations                     |                                         |   |   | 51    |   |

|     |  |                                                                                                                           |        |  |                                                              |        |  |
|-----|--|---------------------------------------------------------------------------------------------------------------------------|--------|--|--------------------------------------------------------------|--------|--|
| 671 |  | Number of Detects                                                                                                         | 74     |  | Number of Non-Detects                                        | 10     |  |
| 672 |  | Number of Distinct Detects                                                                                                | 44     |  | Number of Distinct Non-Detects                               | 7      |  |
| 673 |  | Minimum Detect                                                                                                            | 0.044  |  | Minimum Non-Detect                                           | 0.038  |  |
| 674 |  | Maximum Detect                                                                                                            | 2.8    |  | Maximum Non-Detect                                           | 0.506  |  |
| 675 |  | Variance Detects                                                                                                          | 0.316  |  | Percent Non-Detects                                          | 11.9%  |  |
| 676 |  | Mean Detects                                                                                                              | 0.385  |  | SD Detects                                                   | 0.562  |  |
| 677 |  | Median Detects                                                                                                            | 0.185  |  | CV Detects                                                   | 1.457  |  |
| 678 |  | Skewness Detects                                                                                                          | 3.042  |  | Kurtosis Detects                                             | 9.438  |  |
| 679 |  | Mean of Logged Detects                                                                                                    | -1.512 |  | SD of Logged Detects                                         | 0.956  |  |
| 680 |  |                                                                                                                           |        |  |                                                              |        |  |
| 681 |  | <b>Normal GOF Test on Detects Only</b>                                                                                    |        |  |                                                              |        |  |
| 682 |  | Shapiro Wilk Test Statistic                                                                                               | 0.568  |  | <b>Normal GOF Test on Detected Observations Only</b>         |        |  |
| 683 |  | 5% Shapiro Wilk P Value                                                                                                   | 0      |  | Detected Data Not Normal at 5% Significance Level            |        |  |
| 684 |  | Lilliefors Test Statistic                                                                                                 | 0.276  |  | <b>Lilliefors GOF Test</b>                                   |        |  |
| 685 |  | 5% Lilliefors Critical Value                                                                                              | 0.103  |  | Detected Data Not Normal at 5% Significance Level            |        |  |
| 686 |  | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                  |        |  |                                                              |        |  |
| 687 |  |                                                                                                                           |        |  |                                                              |        |  |
| 688 |  | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |        |  |                                                              |        |  |
| 689 |  | KM Mean                                                                                                                   | 0.36   |  | KM Standard Error of Mean                                    | 0.0584 |  |
| 690 |  | KM SD                                                                                                                     | 0.53   |  | 95% KM (BCA) UCL                                             | 0.46   |  |
| 691 |  | 95% KM (t) UCL                                                                                                            | 0.457  |  | 95% KM (Percentile Bootstrap) UCL                            | 0.463  |  |
| 692 |  | 95% KM (z) UCL                                                                                                            | 0.456  |  | 95% KM Bootstrap t UCL                                       | 0.495  |  |
| 693 |  | 90% KM Chebyshev UCL                                                                                                      | 0.535  |  | 95% KM Chebyshev UCL                                         | 0.614  |  |
| 694 |  | 97.5% KM Chebyshev UCL                                                                                                    | 0.724  |  | 99% KM Chebyshev UCL                                         | 0.94   |  |
| 695 |  |                                                                                                                           |        |  |                                                              |        |  |
| 696 |  | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |        |  |                                                              |        |  |
| 697 |  | A-D Test Statistic                                                                                                        | 4.168  |  | <b>Anderson-Darling GOF Test</b>                             |        |  |
| 698 |  | 5% A-D Critical Value                                                                                                     | 0.78   |  | Detected Data Not Gamma Distributed at 5% Significance Level |        |  |
| 699 |  | K-S Test Statistic                                                                                                        | 0.205  |  | <b>Kolmogorov-Smirnov GOF</b>                                |        |  |
| 700 |  | 5% K-S Critical Value                                                                                                     | 0.107  |  | Detected Data Not Gamma Distributed at 5% Significance Level |        |  |
| 701 |  | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                       |        |  |                                                              |        |  |
| 702 |  |                                                                                                                           |        |  |                                                              |        |  |
| 703 |  | <b>Gamma Statistics on Detected Data Only</b>                                                                             |        |  |                                                              |        |  |
| 704 |  | k hat (MLE)                                                                                                               | 1.029  |  | k star (bias corrected MLE)                                  | 0.996  |  |
| 705 |  | Theta hat (MLE)                                                                                                           | 0.375  |  | Theta star (bias corrected MLE)                              | 0.387  |  |
| 706 |  | nu hat (MLE)                                                                                                              | 152.3  |  | nu star (bias corrected)                                     | 147.5  |  |
| 707 |  | Mean (detects)                                                                                                            | 0.385  |  |                                                              |        |  |
| 708 |  |                                                                                                                           |        |  |                                                              |        |  |
| 709 |  | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |        |  |                                                              |        |  |
| 710 |  | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |        |  |                                                              |        |  |
| 711 |  | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |        |  |                                                              |        |  |
| 712 |  | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |        |  |                                                              |        |  |
| 713 |  | This is especially true when the sample size is small.                                                                    |        |  |                                                              |        |  |
| 714 |  | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |        |  |                                                              |        |  |
| 715 |  | Minimum                                                                                                                   | 0.01   |  | Mean                                                         | 0.355  |  |
| 716 |  | Maximum                                                                                                                   | 2.8    |  | Median                                                       | 0.18   |  |
| 717 |  | SD                                                                                                                        | 0.535  |  | CV                                                           | 1.508  |  |
| 718 |  | k hat (MLE)                                                                                                               | 0.932  |  | k star (bias corrected MLE)                                  | 0.907  |  |
| 719 |  | Theta hat (MLE)                                                                                                           | 0.38   |  | Theta star (bias corrected MLE)                              | 0.391  |  |
| 720 |  | nu hat (MLE)                                                                                                              | 156.6  |  | nu star (bias corrected)                                     | 152.4  |  |
| 721 |  | Adjusted Level of Significance ( $\beta$ )                                                                                | 0.0471 |  |                                                              |        |  |
| 722 |  | Approximate Chi Square Value (152.36, $\alpha$ )                                                                          | 124.8  |  | Adjusted Chi Square Value (152.36, $\beta$ )                 | 124.4  |  |
| 723 |  | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         | 0.433  |  | 95% Gamma Adjusted UCL (use when $n < 50$ )                  | 0.434  |  |
| 724 |  |                                                                                                                           |        |  |                                                              |        |  |
| 725 |  | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |        |  |                                                              |        |  |
| 726 |  | Mean (KM)                                                                                                                 | 0.36   |  | SD (KM)                                                      | 0.53   |  |
| 727 |  | Variance (KM)                                                                                                             | 0.281  |  | SE of Mean (KM)                                              | 0.0584 |  |
| 728 |  | k hat (KM)                                                                                                                | 0.461  |  | k star (KM)                                                  | 0.452  |  |
| 729 |  | nu hat (KM)                                                                                                               | 77.39  |  | nu star (KM)                                                 | 75.96  |  |
| 730 |  | theta hat (KM)                                                                                                            | 0.781  |  | theta star (KM)                                              | 0.795  |  |
| 731 |  | 80% gamma percentile (KM)                                                                                                 | 0.587  |  | 90% gamma percentile (KM)                                    | 0.993  |  |
| 732 |  | 95% gamma percentile (KM)                                                                                                 | 1.431  |  | 99% gamma percentile (KM)                                    | 2.521  |  |
| 733 |  |                                                                                                                           |        |  |                                                              |        |  |
| 734 |  | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |        |  |                                                              |        |  |
| 735 |  | Approximate Chi Square Value (75.96, $\alpha$ )                                                                           | 56.89  |  | Adjusted Chi Square Value (75.96, $\beta$ )                  | 56.6   |  |
| 736 |  | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       | 0.48   |  | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )               | 0.483  |  |
| 737 |  |                                                                                                                           |        |  |                                                              |        |  |

| A   | B                                                                                                                                         | C | F         | G                                                    | H | I | J | K      | L |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------|---|-----------|------------------------------------------------------|---|---|---|--------|---|
| 738 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                   |   |           |                                                      |   |   |   |        |   |
| 739 | Shapiro Wilk Approximate Test Statistic                                                                                                   |   | 0.931     | <b>Shapiro Wilk GOF Test</b>                         |   |   |   |        |   |
| 740 | 5% Shapiro Wilk P Value                                                                                                                   |   | 5.6713E-4 | Detected Data Not Lognormal at 5% Significance Level |   |   |   |        |   |
| 741 | Lilliefors Test Statistic                                                                                                                 |   | 0.136     | <b>Lilliefors GOF Test</b>                           |   |   |   |        |   |
| 742 | 5% Lilliefors Critical Value                                                                                                              |   | 0.103     | Detected Data Not Lognormal at 5% Significance Level |   |   |   |        |   |
| 743 | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                                               |   |           |                                                      |   |   |   |        |   |
| 744 |                                                                                                                                           |   |           |                                                      |   |   |   |        |   |
| 745 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                 |   |           |                                                      |   |   |   |        |   |
| 746 | Mean in Original Scale                                                                                                                    |   | 0.359     | Mean in Log Scale                                    |   |   |   | -1.571 |   |
| 747 | SD in Original Scale                                                                                                                      |   | 0.532     | SD in Log Scale                                      |   |   |   | 0.945  |   |
| 748 | 95% t UCL (assumes normality of ROS data)                                                                                                 |   | 0.455     | 95% Percentile Bootstrap UCL                         |   |   |   | 0.467  |   |
| 749 | 95% BCA Bootstrap UCL                                                                                                                     |   | 0.476     | 95% Bootstrap t UCL                                  |   |   |   | 0.493  |   |
| 750 | 95% H-UCL (Log ROS)                                                                                                                       |   | 0.408     |                                                      |   |   |   |        |   |
| 751 |                                                                                                                                           |   |           |                                                      |   |   |   |        |   |
| 752 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                   |   |           |                                                      |   |   |   |        |   |
| 753 | KM Mean (logged)                                                                                                                          |   | -1.572    | KM Geo Mean                                          |   |   |   | 0.208  |   |
| 754 | KM SD (logged)                                                                                                                            |   | 0.939     | 95% Critical H Value (KM-Log)                        |   |   |   | 2.18   |   |
| 755 | KM Standard Error of Mean (logged)                                                                                                        |   | 0.106     | 95% H-UCL (KM -Log)                                  |   |   |   | 0.404  |   |
| 756 | KM SD (logged)                                                                                                                            |   | 0.939     | 95% Critical H Value (KM-Log)                        |   |   |   | 2.18   |   |
| 757 | KM Standard Error of Mean (logged)                                                                                                        |   | 0.106     |                                                      |   |   |   |        |   |
| 758 |                                                                                                                                           |   |           |                                                      |   |   |   |        |   |
| 759 | <b>DL/2 Statistics</b>                                                                                                                    |   |           |                                                      |   |   |   |        |   |
| 760 | <b>DL/2 Normal</b>                                                                                                                        |   |           | <b>DL/2 Log-Transformed</b>                          |   |   |   |        |   |
| 761 | Mean in Original Scale                                                                                                                    |   | 0.367     | Mean in Log Scale                                    |   |   |   | -1.528 |   |
| 762 | SD in Original Scale                                                                                                                      |   | 0.53      | SD in Log Scale                                      |   |   |   | 0.937  |   |
| 763 | 95% t UCL (Assumes normality)                                                                                                             |   | 0.463     | 95% H-Stat UCL                                       |   |   |   | 0.421  |   |
| 764 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                  |   |           |                                                      |   |   |   |        |   |
| 765 |                                                                                                                                           |   |           |                                                      |   |   |   |        |   |
| 766 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                     |   |           |                                                      |   |   |   |        |   |
| 767 | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                             |   |           |                                                      |   |   |   |        |   |
| 768 |                                                                                                                                           |   |           |                                                      |   |   |   |        |   |
| 769 | <b>Suggested UCL to Use</b>                                                                                                               |   |           |                                                      |   |   |   |        |   |
| 770 | 95% KM (Chebyshev) UCL                                                                                                                    |   | 0.614     |                                                      |   |   |   |        |   |
| 771 |                                                                                                                                           |   |           |                                                      |   |   |   |        |   |
| 772 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |   |           |                                                      |   |   |   |        |   |
| 773 | Recommendations are based upon data size, data distribution, and skewness.                                                                |   |           |                                                      |   |   |   |        |   |
| 774 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |   |           |                                                      |   |   |   |        |   |
| 775 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |   |           |                                                      |   |   |   |        |   |
| 776 |                                                                                                                                           |   |           |                                                      |   |   |   |        |   |
| 777 |                                                                                                                                           |   |           |                                                      |   |   |   |        |   |
| 778 | <b>Result (eu5b_zinc_soil-road)</b>                                                                                                       |   |           |                                                      |   |   |   |        |   |
| 779 |                                                                                                                                           |   |           |                                                      |   |   |   |        |   |
| 780 | <b>General Statistics</b>                                                                                                                 |   |           |                                                      |   |   |   |        |   |
| 781 | Total Number of Observations                                                                                                              |   | 85        | Number of Distinct Observations                      |   |   |   | 84     |   |
| 782 |                                                                                                                                           |   |           | Number of Missing Observations                       |   |   |   | 0      |   |
| 783 | Minimum                                                                                                                                   |   | 26.8      | Mean                                                 |   |   |   | 812.9  |   |
| 784 | Maximum                                                                                                                                   |   | 6270      | Median                                               |   |   |   | 412    |   |
| 785 | SD                                                                                                                                        |   | 1169      | Std. Error of Mean                                   |   |   |   | 126.7  |   |
| 786 | Coefficient of Variation                                                                                                                  |   | 1.437     | Skewness                                             |   |   |   | 3.087  |   |
| 787 |                                                                                                                                           |   |           |                                                      |   |   |   |        |   |
| 788 | <b>Normal GOF Test</b>                                                                                                                    |   |           |                                                      |   |   |   |        |   |
| 789 | Shapiro Wilk Test Statistic                                                                                                               |   | 0.597     | <b>Shapiro Wilk GOF Test</b>                         |   |   |   |        |   |
| 790 | 5% Shapiro Wilk P Value                                                                                                                   |   | 0         | Data Not Normal at 5% Significance Level             |   |   |   |        |   |
| 791 | Lilliefors Test Statistic                                                                                                                 |   | 0.251     | <b>Lilliefors GOF Test</b>                           |   |   |   |        |   |
| 792 | 5% Lilliefors Critical Value                                                                                                              |   | 0.0962    | Data Not Normal at 5% Significance Level             |   |   |   |        |   |
| 793 | <b>Data Not Normal at 5% Significance Level</b>                                                                                           |   |           |                                                      |   |   |   |        |   |
| 794 |                                                                                                                                           |   |           |                                                      |   |   |   |        |   |
| 795 | <b>Assuming Normal Distribution</b>                                                                                                       |   |           |                                                      |   |   |   |        |   |
| 796 | <b>95% Normal UCL</b>                                                                                                                     |   |           | <b>95% UCLs (Adjusted for Skewness)</b>              |   |   |   |        |   |
| 797 | 95% Student's-t UCL                                                                                                                       |   | 1024      | 95% Adjusted-CLT UCL (Chen-1995)                     |   |   |   | 1067   |   |
| 798 |                                                                                                                                           |   |           | 95% Modified-t UCL (Johnson-1978)                    |   |   |   | 1031   |   |
| 799 |                                                                                                                                           |   |           |                                                      |   |   |   |        |   |
| 800 | <b>Gamma GOF Test</b>                                                                                                                     |   |           |                                                      |   |   |   |        |   |
| 801 | A-D Test Statistic                                                                                                                        |   | 2.249     | <b>Anderson-Darling Gamma GOF Test</b>               |   |   |   |        |   |
| 802 | 5% A-D Critical Value                                                                                                                     |   | 0.785     | Data Not Gamma Distributed at 5% Significance Level  |   |   |   |        |   |
| 803 | K-S Test Statistic                                                                                                                        |   | 0.112     | <b>Kolmogorov-Smirnov Gamma GOF Test</b>             |   |   |   |        |   |
| 804 | 5% K-S Critical Value                                                                                                                     |   | 0.1       | Data Not Gamma Distributed at 5% Significance Level  |   |   |   |        |   |

|     | A                                                                                                                                         | B      | C | D | E | F | G                                   | H | I                                              | J     | K | L     |  |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------|--------|---|---|---|---|-------------------------------------|---|------------------------------------------------|-------|---|-------|--|
| 805 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                                |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 806 |                                                                                                                                           |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 807 | <b>Gamma Statistics</b>                                                                                                                   |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 808 | k hat (MLE)                                                                                                                               | 0.934  |   |   |   |   |                                     |   | k star (bias corrected MLE)                    | 0.909 |   |       |  |
| 809 | Theta hat (MLE)                                                                                                                           | 870.6  |   |   |   |   |                                     |   | Theta star (bias corrected MLE)                | 894.7 |   |       |  |
| 810 | nu hat (MLE)                                                                                                                              | 158.7  |   |   |   |   |                                     |   | nu star (bias corrected)                       | 154.5 |   |       |  |
| 811 | MLE Mean (bias corrected)                                                                                                                 | 812.9  |   |   |   |   |                                     |   | MLE Sd (bias corrected)                        | 852.8 |   |       |  |
| 812 |                                                                                                                                           |        |   |   |   |   | Approximate Chi Square Value (0.05) |   |                                                | 126.7 |   |       |  |
| 813 | Adjusted Level of Significance                                                                                                            | 0.0472 |   |   |   |   |                                     |   | Adjusted Chi Square Value                      |       |   | 126.3 |  |
| 814 |                                                                                                                                           |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 815 | <b>Assuming Gamma Distribution</b>                                                                                                        |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 816 | 95% Approximate Gamma UCL (use when n>=50))                                                                                               | 990.8  |   |   |   |   |                                     |   | 95% Adjusted Gamma UCL (use when n<50)         | 994.2 |   |       |  |
| 817 |                                                                                                                                           |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 818 | <b>Lognormal GOF Test</b>                                                                                                                 |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 819 | Shapiro Wilk Test Statistic                                                                                                               | 0.982  |   |   |   |   |                                     |   | <b>Shapiro Wilk Lognormal GOF Test</b>         |       |   |       |  |
| 820 | 5% Shapiro Wilk P Value                                                                                                                   | 0.661  |   |   |   |   |                                     |   | Data appear Lognormal at 5% Significance Level |       |   |       |  |
| 821 | Lilliefors Test Statistic                                                                                                                 | 0.0488 |   |   |   |   |                                     |   | <b>Lilliefors Lognormal GOF Test</b>           |       |   |       |  |
| 822 | 5% Lilliefors Critical Value                                                                                                              | 0.0962 |   |   |   |   |                                     |   | Data appear Lognormal at 5% Significance Level |       |   |       |  |
| 823 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                     |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 824 |                                                                                                                                           |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 825 | <b>Lognormal Statistics</b>                                                                                                               |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 826 | Minimum of Logged Data                                                                                                                    | 3.288  |   |   |   |   |                                     |   | Mean of logged Data                            | 6.077 |   |       |  |
| 827 | Maximum of Logged Data                                                                                                                    | 8.744  |   |   |   |   |                                     |   | SD of logged Data                              | 1.1   |   |       |  |
| 828 |                                                                                                                                           |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 829 | <b>Assuming Lognormal Distribution</b>                                                                                                    |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 830 | 95% H-UCL                                                                                                                                 | 1056   |   |   |   |   |                                     |   | 90% Chebyshev (MVUE) UCL                       | 1136  |   |       |  |
| 831 | 95% Chebyshev (MVUE) UCL                                                                                                                  | 1293   |   |   |   |   |                                     |   | 97.5% Chebyshev (MVUE) UCL                     | 1511  |   |       |  |
| 832 | 99% Chebyshev (MVUE) UCL                                                                                                                  | 1940   |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 833 |                                                                                                                                           |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 834 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                     |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 835 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                          |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 836 |                                                                                                                                           |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 837 | <b>Nonparametric Distribution Free UCLs</b>                                                                                               |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 838 | 95% CLT UCL                                                                                                                               | 1021   |   |   |   |   |                                     |   | 95% Jackknife UCL                              | 1024  |   |       |  |
| 839 | 95% Standard Bootstrap UCL                                                                                                                | 1018   |   |   |   |   |                                     |   | 95% Bootstrap-t UCL                            | 1099  |   |       |  |
| 840 | 95% Hall's Bootstrap UCL                                                                                                                  | 1076   |   |   |   |   |                                     |   | 95% Percentile Bootstrap UCL                   | 1027  |   |       |  |
| 841 | 95% BCA Bootstrap UCL                                                                                                                     | 1062   |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 842 | 90% Chebyshev(Mean, Sd) UCL                                                                                                               | 1193   |   |   |   |   |                                     |   | 95% Chebyshev(Mean, Sd) UCL                    | 1365  |   |       |  |
| 843 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                             | 1604   |   |   |   |   |                                     |   | 99% Chebyshev(Mean, Sd) UCL                    | 2074  |   |       |  |
| 844 |                                                                                                                                           |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 845 | <b>Suggested UCL to Use</b>                                                                                                               |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 846 | 95% H-UCL                                                                                                                                 | 1056   |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 847 |                                                                                                                                           |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 848 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 849 | Recommendations are based upon data size, data distribution, and skewness.                                                                |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 850 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 851 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 852 |                                                                                                                                           |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 853 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                    |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 854 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>             |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 855 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                        |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 856 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>         |        |   |   |   |   |                                     |   |                                                |       |   |       |  |
| 857 |                                                                                                                                           |        |   |   |   |   |                                     |   |                                                |       |   |       |  |

| A  | B                                                                                                                         | C                               | D                                                            | E | F | G | H | I                                          | J      | K | L |  |
|----|---------------------------------------------------------------------------------------------------------------------------|---------------------------------|--------------------------------------------------------------|---|---|---|---|--------------------------------------------|--------|---|---|--|
| 1  | <b>UCL Statistics for Data Sets with Non-Detects</b>                                                                      |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 2  |                                                                                                                           |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 3  | User Selected Options                                                                                                     |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 4  | Date/Time of Computation                                                                                                  | ProUCL 5.13/21/2019 10:06:00 AM |                                                              |   |   |   |   |                                            |        |   |   |  |
| 5  | From File                                                                                                                 | BPMD_HHRA_CMP_SoilInput_v2.xls  |                                                              |   |   |   |   |                                            |        |   |   |  |
| 6  | Full Precision                                                                                                            | OFF                             |                                                              |   |   |   |   |                                            |        |   |   |  |
| 7  | Confidence Coefficient                                                                                                    | 95%                             |                                                              |   |   |   |   |                                            |        |   |   |  |
| 8  | Number of Bootstrap Operations                                                                                            | 2000                            |                                                              |   |   |   |   |                                            |        |   |   |  |
| 9  |                                                                                                                           |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 10 | <b>Result (eu7_antimony)</b>                                                                                              |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 11 |                                                                                                                           |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 12 | <b>General Statistics</b>                                                                                                 |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 13 | Total Number of Observations                                                                                              | 13                              |                                                              |   |   |   |   | Number of Distinct Observations            | 12     |   |   |  |
| 14 | Number of Detects                                                                                                         | 12                              |                                                              |   |   |   |   | Number of Non-Detects                      | 1      |   |   |  |
| 15 | Number of Distinct Detects                                                                                                | 12                              |                                                              |   |   |   |   | Number of Distinct Non-Detects             | 1      |   |   |  |
| 16 | Minimum Detect                                                                                                            | 0.57                            |                                                              |   |   |   |   | Minimum Non-Detect                         | 1.2    |   |   |  |
| 17 | Maximum Detect                                                                                                            | 77.6                            |                                                              |   |   |   |   | Maximum Non-Detect                         | 1.2    |   |   |  |
| 18 | Variance Detects                                                                                                          | 531.5                           |                                                              |   |   |   |   | Percent Non-Detects                        | 7.6929 |   |   |  |
| 19 | Mean Detects                                                                                                              | 12.9                            |                                                              |   |   |   |   | SD Detects                                 | 23.05  |   |   |  |
| 20 | Median Detects                                                                                                            | 1.595                           |                                                              |   |   |   |   | CV Detects                                 | 1.787  |   |   |  |
| 21 | Skewness Detects                                                                                                          | 2.376                           |                                                              |   |   |   |   | Kurtosis Detects                           | 5.916  |   |   |  |
| 22 | Mean of Logged Detects                                                                                                    | 1.14                            |                                                              |   |   |   |   | SD of Logged Detects                       | 1.723  |   |   |  |
| 23 |                                                                                                                           |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 24 | <b>Normal GOF Test on Detects Only</b>                                                                                    |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 25 | Shapiro Wilk Test Statistic                                                                                               | 0.616                           |                                                              |   |   |   |   | <b>Shapiro Wilk GOF Test</b>               |        |   |   |  |
| 26 | 5% Shapiro Wilk Critical Value                                                                                            | 0.859                           | Detected Data Not Normal at 5% Significance Level            |   |   |   |   |                                            |        |   |   |  |
| 27 | Lilliefors Test Statistic                                                                                                 | 0.351                           |                                                              |   |   |   |   | <b>Lilliefors GOF Test</b>                 |        |   |   |  |
| 28 | 5% Lilliefors Critical Value                                                                                              | 0.243                           | Detected Data Not Normal at 5% Significance Level            |   |   |   |   |                                            |        |   |   |  |
| 29 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                  |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 30 |                                                                                                                           |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 31 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 32 | KM Mean                                                                                                                   | 11.96                           |                                                              |   |   |   |   | KM Standard Error of Mean                  | 6.215  |   |   |  |
| 33 | KM SD                                                                                                                     | 21.45                           |                                                              |   |   |   |   | 95% KM (BCA) UCL                           | 22.09  |   |   |  |
| 34 | 95% KM (t) UCL                                                                                                            | 23.04                           |                                                              |   |   |   |   | 95% KM (Percentile Bootstrap) UCL          | 23.1   |   |   |  |
| 35 | 95% KM (z) UCL                                                                                                            | 22.18                           |                                                              |   |   |   |   | 95% KM Bootstrap t UCL                     | 36.89  |   |   |  |
| 36 | 90% KM Chebyshev UCL                                                                                                      | 30.61                           |                                                              |   |   |   |   | 95% KM Chebyshev UCL                       | 39.05  |   |   |  |
| 37 | 97.5% KM Chebyshev UCL                                                                                                    | 50.77                           |                                                              |   |   |   |   | 99% KM Chebyshev UCL                       | 73.8   |   |   |  |
| 38 |                                                                                                                           |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 39 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 40 | A-D Test Statistic                                                                                                        | 1.226                           |                                                              |   |   |   |   | <b>Anderson-Darling GOF Test</b>           |        |   |   |  |
| 41 | 5% A-D Critical Value                                                                                                     | 0.794                           | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |   |   |                                            |        |   |   |  |
| 42 | K-S Test Statistic                                                                                                        | 0.348                           |                                                              |   |   |   |   | <b>Kolmogorov-Smirnov GOF</b>              |        |   |   |  |
| 43 | 5% K-S Critical Value                                                                                                     | 0.26                            | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |   |   |                                            |        |   |   |  |
| 44 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                       |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 45 |                                                                                                                           |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 46 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 47 | k hat (MLE)                                                                                                               | 0.455                           |                                                              |   |   |   |   | k star (bias corrected MLE)                | 0.397  |   |   |  |
| 48 | Theta hat (MLE)                                                                                                           | 28.35                           |                                                              |   |   |   |   | Theta star (bias corrected MLE)            | 32.5   |   |   |  |
| 49 | nu hat (MLE)                                                                                                              | 10.92                           |                                                              |   |   |   |   | nu star (bias corrected)                   | 9.524  |   |   |  |
| 50 | Mean (detects)                                                                                                            | 12.9                            |                                                              |   |   |   |   |                                            |        |   |   |  |
| 51 |                                                                                                                           |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 52 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 53 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 54 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 55 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 56 | This is especially true when the sample size is small.                                                                    |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 57 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |
| 58 | Minimum                                                                                                                   | 0.01                            |                                                              |   |   |   |   | Mean                                       | 11.91  |   |   |  |
| 59 | Maximum                                                                                                                   | 77.6                            |                                                              |   |   |   |   | Median                                     | 1.4    |   |   |  |
| 60 | SD                                                                                                                        | 22.36                           |                                                              |   |   |   |   | CV                                         | 1.878  |   |   |  |
| 61 | k hat (MLE)                                                                                                               | 0.374                           |                                                              |   |   |   |   | k star (bias corrected MLE)                | 0.339  |   |   |  |
| 62 | Theta hat (MLE)                                                                                                           | 31.84                           |                                                              |   |   |   |   | Theta star (bias corrected MLE)            | 35.13  |   |   |  |
| 63 | nu hat (MLE)                                                                                                              | 9.724                           |                                                              |   |   |   |   | nu star (bias corrected)                   | 8.813  |   |   |  |
| 64 | Adjusted Level of Significance ( $\beta$ )                                                                                | 0.0301                          |                                                              |   |   |   |   |                                            |        |   |   |  |
| 65 | Approximate Chi Square Value (8.81, $\alpha$ )                                                                            | 3.215                           |                                                              |   |   |   |   | Adjusted Chi Square Value (8.81, $\beta$ ) | 2.751  |   |   |  |
| 66 | 95% Gamma Approximate UCL (use when n>=50)                                                                                | 32.64                           |                                                              |   |   |   |   | 95% Gamma Adjusted UCL (use when n<50)     | 38.14  |   |   |  |
| 67 |                                                                                                                           |                                 |                                                              |   |   |   |   |                                            |        |   |   |  |

| A   | B                                                                                                                                         | C     | D | E                                                    | F     | G                           | H | I | J | K | L |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------|-------|---|------------------------------------------------------|-------|-----------------------------|---|---|---|---|---|
| 68  | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                   |       |   |                                                      |       |                             |   |   |   |   |   |
| 69  | Mean (KM)                                                                                                                                 | 11.96 |   | SD (KM)                                              | 21.45 |                             |   |   |   |   |   |
| 70  | Variance (KM)                                                                                                                             | 460.3 |   | SE of Mean (KM)                                      | 6.215 |                             |   |   |   |   |   |
| 71  | k hat (KM)                                                                                                                                | 0.311 |   | k star (KM)                                          | 0.29  |                             |   |   |   |   |   |
| 72  | nu hat (KM)                                                                                                                               | 8.081 |   | nu star (KM)                                         | 7.55  |                             |   |   |   |   |   |
| 73  | theta hat (KM)                                                                                                                            | 38.48 |   | theta star (KM)                                      | 41.19 |                             |   |   |   |   |   |
| 74  | 80% gamma percentile (KM)                                                                                                                 | 18.19 |   | 90% gamma percentile (KM)                            | 35.41 |                             |   |   |   |   |   |
| 75  | 95% gamma percentile (KM)                                                                                                                 | 55.29 |   | 99% gamma percentile (KM)                            | 107.2 |                             |   |   |   |   |   |
| 76  |                                                                                                                                           |       |   |                                                      |       |                             |   |   |   |   |   |
| 77  | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                 |       |   |                                                      |       |                             |   |   |   |   |   |
| 78  | Approximate Chi Square Value (7.55, $\alpha$ )                                                                                            | 2.477 |   | Adjusted Chi Square Value (7.55, $\beta$ )           | 2.083 |                             |   |   |   |   |   |
| 79  | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                       | 36.45 |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )       | 43.35 |                             |   |   |   |   |   |
| 80  |                                                                                                                                           |       |   |                                                      |       |                             |   |   |   |   |   |
| 81  | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                   |       |   |                                                      |       |                             |   |   |   |   |   |
| 82  | Shapiro Wilk Test Statistic                                                                                                               | 0.838 |   | <b>Shapiro Wilk GOF Test</b>                         |       |                             |   |   |   |   |   |
| 83  | 5% Shapiro Wilk Critical Value                                                                                                            | 0.859 |   | Detected Data Not Lognormal at 5% Significance Level |       |                             |   |   |   |   |   |
| 84  | Lilliefors Test Statistic                                                                                                                 | 0.288 |   | <b>Lilliefors GOF Test</b>                           |       |                             |   |   |   |   |   |
| 85  | 5% Lilliefors Critical Value                                                                                                              | 0.243 |   | Detected Data Not Lognormal at 5% Significance Level |       |                             |   |   |   |   |   |
| 86  | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                                               |       |   |                                                      |       |                             |   |   |   |   |   |
| 87  |                                                                                                                                           |       |   |                                                      |       |                             |   |   |   |   |   |
| 88  | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                 |       |   |                                                      |       |                             |   |   |   |   |   |
| 89  | Mean in Original Scale                                                                                                                    | 11.95 |   | Mean in Log Scale                                    | 1.011 |                             |   |   |   |   |   |
| 90  | SD in Original Scale                                                                                                                      | 22.34 |   | SD in Log Scale                                      | 1.714 |                             |   |   |   |   |   |
| 91  | 95% t UCL (assumes normality of ROS data)                                                                                                 | 22.99 |   | 95% Percentile Bootstrap UCL                         | 23.48 |                             |   |   |   |   |   |
| 92  | 95% BCA Bootstrap UCL                                                                                                                     | 27.61 |   | 95% Bootstrap t UCL                                  | 37.03 |                             |   |   |   |   |   |
| 93  | 95% H-UCL (Log ROS)                                                                                                                       | 93.95 |   |                                                      |       |                             |   |   |   |   |   |
| 94  |                                                                                                                                           |       |   |                                                      |       |                             |   |   |   |   |   |
| 95  | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                   |       |   |                                                      |       |                             |   |   |   |   |   |
| 96  | KM Mean (logged)                                                                                                                          | 1.026 |   | KM Geo Mean                                          | 2.79  |                             |   |   |   |   |   |
| 97  | KM SD (logged)                                                                                                                            | 1.634 |   | 95% Critical H Value (KM-Log)                        | 4.027 |                             |   |   |   |   |   |
| 98  | KM Standard Error of Mean (logged)                                                                                                        | 0.474 |   | 95% H-UCL (KM -Log)                                  | 70.86 |                             |   |   |   |   |   |
| 99  | KM SD (logged)                                                                                                                            | 1.634 |   | 95% Critical H Value (KM-Log)                        | 4.027 |                             |   |   |   |   |   |
| 100 | KM Standard Error of Mean (logged)                                                                                                        | 0.474 |   |                                                      |       |                             |   |   |   |   |   |
| 101 |                                                                                                                                           |       |   |                                                      |       |                             |   |   |   |   |   |
| 102 | <b>DL/2 Statistics</b>                                                                                                                    |       |   |                                                      |       |                             |   |   |   |   |   |
| 103 | <b>DL/2 Normal</b>                                                                                                                        |       |   |                                                      |       | <b>DL/2 Log-Transformed</b> |   |   |   |   |   |
| 104 | Mean in Original Scale                                                                                                                    | 11.95 |   | Mean in Log Scale                                    | 1.013 |                             |   |   |   |   |   |
| 105 | SD in Original Scale                                                                                                                      | 22.33 |   | SD in Log Scale                                      | 1.712 |                             |   |   |   |   |   |
| 106 | 95% t UCL (Assumes normality)                                                                                                             | 22.99 |   | 95% H-Stat UCL                                       | 93.31 |                             |   |   |   |   |   |
| 107 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                  |       |   |                                                      |       |                             |   |   |   |   |   |
| 108 |                                                                                                                                           |       |   |                                                      |       |                             |   |   |   |   |   |
| 109 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                     |       |   |                                                      |       |                             |   |   |   |   |   |
| 110 | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                             |       |   |                                                      |       |                             |   |   |   |   |   |
| 111 |                                                                                                                                           |       |   |                                                      |       |                             |   |   |   |   |   |
| 112 | <b>Suggested UCL to Use</b>                                                                                                               |       |   |                                                      |       |                             |   |   |   |   |   |
| 113 | 975% KM (Chebyshev) UCL                                                                                                                   | 50.77 |   |                                                      |       |                             |   |   |   |   |   |
| 114 |                                                                                                                                           |       |   |                                                      |       |                             |   |   |   |   |   |
| 115 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |       |   |                                                      |       |                             |   |   |   |   |   |
| 116 | Recommendations are based upon data size, data distribution, and skewness.                                                                |       |   |                                                      |       |                             |   |   |   |   |   |
| 117 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |       |   |                                                      |       |                             |   |   |   |   |   |
| 118 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |       |   |                                                      |       |                             |   |   |   |   |   |
| 119 |                                                                                                                                           |       |   |                                                      |       |                             |   |   |   |   |   |
| 120 |                                                                                                                                           |       |   |                                                      |       |                             |   |   |   |   |   |
| 121 | <b>Result (eu7_arsenic)</b>                                                                                                               |       |   |                                                      |       |                             |   |   |   |   |   |
| 122 |                                                                                                                                           |       |   |                                                      |       |                             |   |   |   |   |   |
| 123 | <b>General Statistics</b>                                                                                                                 |       |   |                                                      |       |                             |   |   |   |   |   |
| 124 | Total Number of Observations                                                                                                              | 13    |   | Number of Distinct Observations                      | 13    |                             |   |   |   |   |   |
| 125 |                                                                                                                                           |       |   | Number of Missing Observations                       | 0     |                             |   |   |   |   |   |
| 126 | Minimum                                                                                                                                   | 7.7   |   | Mean                                                 | 33.69 |                             |   |   |   |   |   |
| 127 | Maximum                                                                                                                                   | 73.5  |   | Median                                               | 29.5  |                             |   |   |   |   |   |
| 128 | SD                                                                                                                                        | 22.6  |   | Std. Error of Mean                                   | 6.267 |                             |   |   |   |   |   |
| 129 | Coefficient of Variation                                                                                                                  | 0.671 |   | Skewness                                             | 0.695 |                             |   |   |   |   |   |
| 130 |                                                                                                                                           |       |   |                                                      |       |                             |   |   |   |   |   |
| 131 | <b>Normal GOF Test</b>                                                                                                                    |       |   |                                                      |       |                             |   |   |   |   |   |
| 132 | Shapiro Wilk Test Statistic                                                                                                               | 0.899 |   | <b>Shapiro Wilk GOF Test</b>                         |       |                             |   |   |   |   |   |
| 133 | 5% Shapiro Wilk Critical Value                                                                                                            | 0.866 |   | Data appear Normal at 5% Significance Level          |       |                             |   |   |   |   |   |
| 134 | Lilliefors Test Statistic                                                                                                                 | 0.175 |   | <b>Lilliefors GOF Test</b>                           |       |                             |   |   |   |   |   |

| A   | B                                                                                                                                         | C | D | E      | F                                                               | G | H | I | J     | K | L |  |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------------------|---|---|---|-------|---|---|--|
| 135 | 5% Lilliefors Critical Value                                                                                                              |   |   | 0.234  | Data appear Normal at 5% Significance Level                     |   |   |   |       |   |   |  |
| 136 | Data appear Normal at 5% Significance Level                                                                                               |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 137 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 138 | Assuming Normal Distribution                                                                                                              |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 139 | 95% Normal UCL                                                                                                                            |   |   |        | 95% UCLs (Adjusted for Skewness)                                |   |   |   |       |   |   |  |
| 140 | 95% Student's-t UCL                                                                                                                       |   |   | 44.86  | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |   | 45.29 |   |   |  |
| 141 |                                                                                                                                           |   |   |        | 95% Modified-t UCL (Johnson-1978)                               |   |   |   | 45.06 |   |   |  |
| 142 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 143 | Gamma GOF Test                                                                                                                            |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 144 | A-D Test Statistic                                                                                                                        |   |   | 0.291  | Anderson-Darling Gamma GOF Test                                 |   |   |   |       |   |   |  |
| 145 | 5% A-D Critical Value                                                                                                                     |   |   | 0.742  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |       |   |   |  |
| 146 | K-S Test Statistic                                                                                                                        |   |   | 0.14   | Kolmogorov-Smirnov Gamma GOF Test                               |   |   |   |       |   |   |  |
| 147 | 5% K-S Critical Value                                                                                                                     |   |   | 0.239  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |       |   |   |  |
| 148 | Detected data appear Gamma Distributed at 5% Significance Level                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 149 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 150 | Gamma Statistics                                                                                                                          |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 151 | k hat (MLE)                                                                                                                               |   |   | 2.308  | k star (bias corrected MLE)                                     |   |   |   | 1.827 |   |   |  |
| 152 | Theta hat (MLE)                                                                                                                           |   |   | 14.6   | Theta star (bias corrected MLE)                                 |   |   |   | 18.44 |   |   |  |
| 153 | nu hat (MLE)                                                                                                                              |   |   | 60.01  | nu star (bias corrected)                                        |   |   |   | 47.5  |   |   |  |
| 154 | MLE Mean (bias corrected)                                                                                                                 |   |   | 33.69  | MLE Sd (bias corrected)                                         |   |   |   | 24.93 |   |   |  |
| 155 |                                                                                                                                           |   |   |        | Approximate Chi Square Value (0.05)                             |   |   |   | 32.68 |   |   |  |
| 156 | Adjusted Level of Significance                                                                                                            |   |   | 0.0301 | Adjusted Chi Square Value                                       |   |   |   | 30.93 |   |   |  |
| 157 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 158 | Assuming Gamma Distribution                                                                                                               |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 159 | 95% Approximate Gamma UCL (use when n>=50))                                                                                               |   |   | 48.97  | 95% Adjusted Gamma UCL (use when n<50)                          |   |   |   | 51.73 |   |   |  |
| 160 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 161 | Lognormal GOF Test                                                                                                                        |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 162 | Shapiro Wilk Test Statistic                                                                                                               |   |   | 0.949  | Shapiro Wilk Lognormal GOF Test                                 |   |   |   |       |   |   |  |
| 163 | 5% Shapiro Wilk Critical Value                                                                                                            |   |   | 0.866  | Data appear Lognormal at 5% Significance Level                  |   |   |   |       |   |   |  |
| 164 | Lilliefors Test Statistic                                                                                                                 |   |   | 0.132  | Lilliefors Lognormal GOF Test                                   |   |   |   |       |   |   |  |
| 165 | 5% Lilliefors Critical Value                                                                                                              |   |   | 0.234  | Data appear Lognormal at 5% Significance Level                  |   |   |   |       |   |   |  |
| 166 | Data appear Lognormal at 5% Significance Level                                                                                            |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 167 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 168 | Lognormal Statistics                                                                                                                      |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 169 | Minimum of Logged Data                                                                                                                    |   |   | 2.041  | Mean of logged Data                                             |   |   |   | 3.285 |   |   |  |
| 170 | Maximum of Logged Data                                                                                                                    |   |   | 4.297  | SD of logged Data                                               |   |   |   | 0.737 |   |   |  |
| 171 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 172 | Assuming Lognormal Distribution                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 173 | 95% H-UCL                                                                                                                                 |   |   | 58.74  | 90% Chebyshev (MVUE) UCL                                        |   |   |   | 56.21 |   |   |  |
| 174 | 95% Chebyshev (MVUE) UCL                                                                                                                  |   |   | 66.19  | 97.5% Chebyshev (MVUE) UCL                                      |   |   |   | 80.04 |   |   |  |
| 175 | 99% Chebyshev (MVUE) UCL                                                                                                                  |   |   | 107.2  |                                                                 |   |   |   |       |   |   |  |
| 176 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 177 | Nonparametric Distribution Free UCL Statistics                                                                                            |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 178 | Data appear to follow a Discernible Distribution at 5% Significance Level                                                                 |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 179 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 180 | Nonparametric Distribution Free UCLs                                                                                                      |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 181 | 95% CLT UCL                                                                                                                               |   |   | 44     | 95% Jackknife UCL                                               |   |   |   | 44.86 |   |   |  |
| 182 | 95% Standard Bootstrap UCL                                                                                                                |   |   | 43.64  | 95% Bootstrap-t UCL                                             |   |   |   | 46.85 |   |   |  |
| 183 | 95% Hall's Bootstrap UCL                                                                                                                  |   |   | 46.33  | 95% Percentile Bootstrap UCL                                    |   |   |   | 43.87 |   |   |  |
| 184 | 95% BCA Bootstrap UCL                                                                                                                     |   |   | 44.58  |                                                                 |   |   |   |       |   |   |  |
| 185 | 90% Chebyshev(Mean, Sd) UCL                                                                                                               |   |   | 52.49  | 95% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 61.01 |   |   |  |
| 186 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                             |   |   | 72.83  | 99% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 96.05 |   |   |  |
| 187 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 188 | Suggested UCL to Use                                                                                                                      |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 189 | 95% Student's-t UCL                                                                                                                       |   |   | 44.86  |                                                                 |   |   |   |       |   |   |  |
| 190 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 191 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 192 | Recommendations are based upon data size, data distribution, and skewness.                                                                |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 193 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 194 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 195 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 196 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 197 | Result (eu7_cadmium)                                                                                                                      |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 198 |                                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 199 | General Statistics                                                                                                                        |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 200 | Total Number of Observations                                                                                                              |   |   | 13     | Number of Distinct Observations                                 |   |   |   | 13    |   |   |  |
| 201 |                                                                                                                                           |   |   |        | Number of Missing Observations                                  |   |   |   | 0     |   |   |  |

| A   | B                                                                                                                            | C | D | E                                          | F      | G                                       | H | I | J | K                                                               | L     |
|-----|------------------------------------------------------------------------------------------------------------------------------|---|---|--------------------------------------------|--------|-----------------------------------------|---|---|---|-----------------------------------------------------------------|-------|
| 202 |                                                                                                                              |   |   | Minimum                                    | 0.18   |                                         |   |   |   | Mean                                                            | 6.208 |
| 203 |                                                                                                                              |   |   | Maximum                                    | 23.8   |                                         |   |   |   | Median                                                          | 1.62  |
| 204 |                                                                                                                              |   |   | SD                                         | 7.955  |                                         |   |   |   | Std. Error of Mean                                              | 2.206 |
| 205 |                                                                                                                              |   |   | Coefficient of Variation                   | 1.281  |                                         |   |   |   | Skewness                                                        | 1.418 |
| 206 |                                                                                                                              |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 207 | <b>Normal GOF Test</b>                                                                                                       |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 208 |                                                                                                                              |   |   | Shapiro Wilk Test Statistic                | 0.756  |                                         |   |   |   | <b>Shapiro Wilk GOF Test</b>                                    |       |
| 209 |                                                                                                                              |   |   | 5% Shapiro Wilk Critical Value             | 0.866  |                                         |   |   |   | Data Not Normal at 5% Significance Level                        |       |
| 210 |                                                                                                                              |   |   | Lilliefors Test Statistic                  | 0.272  |                                         |   |   |   | <b>Lilliefors GOF Test</b>                                      |       |
| 211 |                                                                                                                              |   |   | 5% Lilliefors Critical Value               | 0.234  |                                         |   |   |   | Data Not Normal at 5% Significance Level                        |       |
| 212 | <b>Data Not Normal at 5% Significance Level</b>                                                                              |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 213 |                                                                                                                              |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 214 | <b>Assuming Normal Distribution</b>                                                                                          |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 215 | <b>95% Normal UCL</b>                                                                                                        |   |   |                                            |        | <b>95% UCLs (Adjusted for Skewness)</b> |   |   |   |                                                                 |       |
| 216 |                                                                                                                              |   |   | 95% Student's-t UCL                        | 10.14  |                                         |   |   |   | 95% Adjusted-CLT UCL (Chen-1995)                                | 10.77 |
| 217 |                                                                                                                              |   |   |                                            |        |                                         |   |   |   | 95% Modified-t UCL (Johnson-1978)                               | 10.29 |
| 218 |                                                                                                                              |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 219 | <b>Gamma GOF Test</b>                                                                                                        |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 220 |                                                                                                                              |   |   | A-D Test Statistic                         | 0.547  |                                         |   |   |   | <b>Anderson-Darling Gamma GOF Test</b>                          |       |
| 221 |                                                                                                                              |   |   | 5% A-D Critical Value                      | 0.776  |                                         |   |   |   | Detected data appear Gamma Distributed at 5% Significance Level |       |
| 222 |                                                                                                                              |   |   | K-S Test Statistic                         | 0.218  |                                         |   |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |       |
| 223 |                                                                                                                              |   |   | 5% K-S Critical Value                      | 0.247  |                                         |   |   |   | Detected data appear Gamma Distributed at 5% Significance Level |       |
| 224 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                       |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 225 |                                                                                                                              |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 226 | <b>Gamma Statistics</b>                                                                                                      |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 227 |                                                                                                                              |   |   | k hat (MLE)                                | 0.672  |                                         |   |   |   | k star (bias corrected MLE)                                     | 0.568 |
| 228 |                                                                                                                              |   |   | Theta hat (MLE)                            | 9.241  |                                         |   |   |   | Theta star (bias corrected MLE)                                 | 10.93 |
| 229 |                                                                                                                              |   |   | nu hat (MLE)                               | 17.47  |                                         |   |   |   | nu star (bias corrected)                                        | 14.77 |
| 230 |                                                                                                                              |   |   | MLE Mean (bias corrected)                  | 6.208  |                                         |   |   |   | MLE Sd (bias corrected)                                         | 8.237 |
| 231 |                                                                                                                              |   |   |                                            |        |                                         |   |   |   | Approximate Chi Square Value (0.05)                             | 7.102 |
| 232 |                                                                                                                              |   |   | Adjusted Level of Significance             | 0.0301 |                                         |   |   |   | Adjusted Chi Square Value                                       | 6.358 |
| 233 |                                                                                                                              |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 234 | <b>Assuming Gamma Distribution</b>                                                                                           |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 235 |                                                                                                                              |   |   | 95% Approximate Gamma UCL (use when n>=50) | 12.91  |                                         |   |   |   | 95% Adjusted Gamma UCL (use when n<50)                          | 14.42 |
| 236 |                                                                                                                              |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 237 | <b>Lognormal GOF Test</b>                                                                                                    |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 238 |                                                                                                                              |   |   | Shapiro Wilk Test Statistic                | 0.951  |                                         |   |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |       |
| 239 |                                                                                                                              |   |   | 5% Shapiro Wilk Critical Value             | 0.866  |                                         |   |   |   | Data appear Lognormal at 5% Significance Level                  |       |
| 240 |                                                                                                                              |   |   | Lilliefors Test Statistic                  | 0.153  |                                         |   |   |   | <b>Lilliefors Lognormal GOF Test</b>                            |       |
| 241 |                                                                                                                              |   |   | 5% Lilliefors Critical Value               | 0.234  |                                         |   |   |   | Data appear Lognormal at 5% Significance Level                  |       |
| 242 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                        |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 243 |                                                                                                                              |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 244 | <b>Lognormal Statistics</b>                                                                                                  |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 245 |                                                                                                                              |   |   | Minimum of Logged Data                     | -1.715 |                                         |   |   |   | Mean of logged Data                                             | 0.921 |
| 246 |                                                                                                                              |   |   | Maximum of Logged Data                     | 3.17   |                                         |   |   |   | SD of logged Data                                               | 1.504 |
| 247 |                                                                                                                              |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 248 | <b>Assuming Lognormal Distribution</b>                                                                                       |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 249 |                                                                                                                              |   |   | 95% H-UCL                                  | 40.35  |                                         |   |   |   | 90% Chebyshev (MVUE) UCL                                        | 15.96 |
| 250 |                                                                                                                              |   |   | 95% Chebyshev (MVUE) UCL                   | 20.17  |                                         |   |   |   | 97.5% Chebyshev (MVUE) UCL                                      | 26.01 |
| 251 |                                                                                                                              |   |   | 99% Chebyshev (MVUE) UCL                   | 37.47  |                                         |   |   |   |                                                                 |       |
| 252 |                                                                                                                              |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 253 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                        |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 254 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                             |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 255 |                                                                                                                              |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 256 | <b>Nonparametric Distribution Free UCLs</b>                                                                                  |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 257 |                                                                                                                              |   |   | 95% CLT UCL                                | 9.838  |                                         |   |   |   | 95% Jackknife UCL                                               | 10.14 |
| 258 |                                                                                                                              |   |   | 95% Standard Bootstrap UCL                 | 9.757  |                                         |   |   |   | 95% Bootstrap-t UCL                                             | 12.07 |
| 259 |                                                                                                                              |   |   | 95% Hall's Bootstrap UCL                   | 10.68  |                                         |   |   |   | 95% Percentile Bootstrap UCL                                    | 9.917 |
| 260 |                                                                                                                              |   |   | 95% BCA Bootstrap UCL                      | 10.48  |                                         |   |   |   |                                                                 |       |
| 261 |                                                                                                                              |   |   | 90% Chebyshev(Mean, Sd) UCL                | 12.83  |                                         |   |   |   | 95% Chebyshev(Mean, Sd) UCL                                     | 15.83 |
| 262 |                                                                                                                              |   |   | 97.5% Chebyshev(Mean, Sd) UCL              | 19.99  |                                         |   |   |   | 99% Chebyshev(Mean, Sd) UCL                                     | 28.16 |
| 263 |                                                                                                                              |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 264 | <b>Suggested UCL to Use</b>                                                                                                  |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 265 |                                                                                                                              |   |   | 95% Adjusted Gamma UCL                     | 14.42  |                                         |   |   |   |                                                                 |       |
| 266 |                                                                                                                              |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 267 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. |   |   |                                            |        |                                         |   |   |   |                                                                 |       |
| 268 | Recommendations are based upon data size, data distribution, and skewness.                                                   |   |   |                                            |        |                                         |   |   |   |                                                                 |       |

| A   | B                                                                                                                                        | C      | E | F | G                                       | H                                                               | I     | J | K | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|--------|---|---|-----------------------------------------|-----------------------------------------------------------------|-------|---|---|---|
| 269 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |   |   |                                         |                                                                 |       |   |   |   |
| 270 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |   |   |                                         |                                                                 |       |   |   |   |
| 271 |                                                                                                                                          |        |   |   |                                         |                                                                 |       |   |   |   |
| 272 |                                                                                                                                          |        |   |   |                                         |                                                                 |       |   |   |   |
| 273 | <b>Result (eu7_chromium)</b>                                                                                                             |        |   |   |                                         |                                                                 |       |   |   |   |
| 274 |                                                                                                                                          |        |   |   |                                         |                                                                 |       |   |   |   |
| 275 | <b>General Statistics</b>                                                                                                                |        |   |   |                                         |                                                                 |       |   |   |   |
| 276 | Total Number of Observations                                                                                                             | 13     |   |   |                                         | Number of Distinct Observations                                 | 13    |   |   |   |
| 277 |                                                                                                                                          |        |   |   |                                         | Number of Missing Observations                                  | 0     |   |   |   |
| 278 | Minimum                                                                                                                                  | 1.36   |   |   |                                         | Mean                                                            | 5.84  |   |   |   |
| 279 | Maximum                                                                                                                                  | 11.2   |   |   |                                         | Median                                                          | 4.7   |   |   |   |
| 280 | SD                                                                                                                                       | 3.092  |   |   |                                         | Std. Error of Mean                                              | 0.858 |   |   |   |
| 281 | Coefficient of Variation                                                                                                                 | 0.53   |   |   |                                         | Skewness                                                        | 0.439 |   |   |   |
| 282 |                                                                                                                                          |        |   |   |                                         |                                                                 |       |   |   |   |
| 283 | <b>Normal GOF Test</b>                                                                                                                   |        |   |   |                                         |                                                                 |       |   |   |   |
| 284 | Shapiro Wilk Test Statistic                                                                                                              | 0.943  |   |   |                                         | <b>Shapiro Wilk GOF Test</b>                                    |       |   |   |   |
| 285 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.866  |   |   |                                         | Data appear Normal at 5% Significance Level                     |       |   |   |   |
| 286 | Lilliefors Test Statistic                                                                                                                | 0.182  |   |   |                                         | <b>Lilliefors GOF Test</b>                                      |       |   |   |   |
| 287 | 5% Lilliefors Critical Value                                                                                                             | 0.234  |   |   |                                         | Data appear Normal at 5% Significance Level                     |       |   |   |   |
| 288 | <b>Data appear Normal at 5% Significance Level</b>                                                                                       |        |   |   |                                         |                                                                 |       |   |   |   |
| 289 |                                                                                                                                          |        |   |   |                                         |                                                                 |       |   |   |   |
| 290 | <b>Assuming Normal Distribution</b>                                                                                                      |        |   |   |                                         |                                                                 |       |   |   |   |
| 291 | <b>95% Normal UCL</b>                                                                                                                    |        |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |                                                                 |       |   |   |   |
| 292 | 95% Student's-t UCL                                                                                                                      | 7.369  |   |   |                                         | 95% Adjusted-CLT UCL (Chen-1995)                                | 7.362 |   |   |   |
| 293 |                                                                                                                                          |        |   |   |                                         | 95% Modified-t UCL (Johnson-1978)                               | 7.386 |   |   |   |
| 294 |                                                                                                                                          |        |   |   |                                         |                                                                 |       |   |   |   |
| 295 | <b>Gamma GOF Test</b>                                                                                                                    |        |   |   |                                         |                                                                 |       |   |   |   |
| 296 | A-D Test Statistic                                                                                                                       | 0.234  |   |   |                                         | <b>Anderson-Darling Gamma GOF Test</b>                          |       |   |   |   |
| 297 | 5% A-D Critical Value                                                                                                                    | 0.738  |   |   |                                         | Detected data appear Gamma Distributed at 5% Significance Level |       |   |   |   |
| 298 | K-S Test Statistic                                                                                                                       | 0.152  |   |   |                                         | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |       |   |   |   |
| 299 | 5% K-S Critical Value                                                                                                                    | 0.238  |   |   |                                         | Detected data appear Gamma Distributed at 5% Significance Level |       |   |   |   |
| 300 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |        |   |   |                                         |                                                                 |       |   |   |   |
| 301 |                                                                                                                                          |        |   |   |                                         |                                                                 |       |   |   |   |
| 302 | <b>Gamma Statistics</b>                                                                                                                  |        |   |   |                                         |                                                                 |       |   |   |   |
| 303 | k hat (MLE)                                                                                                                              | 3.465  |   |   |                                         | k star (bias corrected MLE)                                     | 2.717 |   |   |   |
| 304 | Theta hat (MLE)                                                                                                                          | 1.685  |   |   |                                         | Theta star (bias corrected MLE)                                 | 2.15  |   |   |   |
| 305 | nu hat (MLE)                                                                                                                             | 90.09  |   |   |                                         | nu star (bias corrected)                                        | 70.64 |   |   |   |
| 306 | MLE Mean (bias corrected)                                                                                                                | 5.84   |   |   |                                         | MLE Sd (bias corrected)                                         | 3.543 |   |   |   |
| 307 |                                                                                                                                          |        |   |   |                                         | Approximate Chi Square Value (0.05)                             | 52.29 |   |   |   |
| 308 | Adjusted Level of Significance                                                                                                           | 0.0301 |   |   |                                         | Adjusted Chi Square Value                                       | 50.04 |   |   |   |
| 309 |                                                                                                                                          |        |   |   |                                         |                                                                 |       |   |   |   |
| 310 | <b>Assuming Gamma Distribution</b>                                                                                                       |        |   |   |                                         |                                                                 |       |   |   |   |
| 311 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | 7.889  |   |   |                                         | 95% Adjusted Gamma UCL (use when n<50)                          | 8.243 |   |   |   |
| 312 |                                                                                                                                          |        |   |   |                                         |                                                                 |       |   |   |   |
| 313 | <b>Lognormal GOF Test</b>                                                                                                                |        |   |   |                                         |                                                                 |       |   |   |   |
| 314 | Shapiro Wilk Test Statistic                                                                                                              | 0.951  |   |   |                                         | <b>Shapiro Wilk Lognormal GOF Test</b>                          |       |   |   |   |
| 315 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.866  |   |   |                                         | Data appear Lognormal at 5% Significance Level                  |       |   |   |   |
| 316 | Lilliefors Test Statistic                                                                                                                | 0.161  |   |   |                                         | <b>Lilliefors Lognormal GOF Test</b>                            |       |   |   |   |
| 317 | 5% Lilliefors Critical Value                                                                                                             | 0.234  |   |   |                                         | Data appear Lognormal at 5% Significance Level                  |       |   |   |   |
| 318 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |        |   |   |                                         |                                                                 |       |   |   |   |
| 319 |                                                                                                                                          |        |   |   |                                         |                                                                 |       |   |   |   |
| 320 | <b>Lognormal Statistics</b>                                                                                                              |        |   |   |                                         |                                                                 |       |   |   |   |
| 321 | Minimum of Logged Data                                                                                                                   | 0.307  |   |   |                                         | Mean of logged Data                                             | 1.614 |   |   |   |
| 322 | Maximum of Logged Data                                                                                                                   | 2.416  |   |   |                                         | SD of logged Data                                               | 0.607 |   |   |   |
| 323 |                                                                                                                                          |        |   |   |                                         |                                                                 |       |   |   |   |
| 324 | <b>Assuming Lognormal Distribution</b>                                                                                                   |        |   |   |                                         |                                                                 |       |   |   |   |
| 325 | 95% H-UCL                                                                                                                                | 8.944  |   |   |                                         | 90% Chebyshev (MVUE) UCL                                        | 9.049 |   |   |   |
| 326 | 95% Chebyshev (MVUE) UCL                                                                                                                 | 10.46  |   |   |                                         | 97.5% Chebyshev (MVUE) UCL                                      | 12.41 |   |   |   |
| 327 | 99% Chebyshev (MVUE) UCL                                                                                                                 | 16.25  |   |   |                                         |                                                                 |       |   |   |   |
| 328 |                                                                                                                                          |        |   |   |                                         |                                                                 |       |   |   |   |
| 329 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |   |   |                                         |                                                                 |       |   |   |   |
| 330 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |        |   |   |                                         |                                                                 |       |   |   |   |
| 331 |                                                                                                                                          |        |   |   |                                         |                                                                 |       |   |   |   |
| 332 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |        |   |   |                                         |                                                                 |       |   |   |   |
| 333 | 95% CLT UCL                                                                                                                              | 7.251  |   |   |                                         | 95% Jackknife UCL                                               | 7.369 |   |   |   |
| 334 | 95% Standard Bootstrap UCL                                                                                                               | 7.188  |   |   |                                         | 95% Bootstrap-t UCL                                             | 7.584 |   |   |   |
| 335 | 95% Hall's Bootstrap UCL                                                                                                                 | 7.304  |   |   |                                         | 95% Percentile Bootstrap UCL                                    | 7.185 |   |   |   |

| A   | B | C                                                                                                                                        | D | E | F     | G | H                                                               | I | J | K | L     |
|-----|---|------------------------------------------------------------------------------------------------------------------------------------------|---|---|-------|---|-----------------------------------------------------------------|---|---|---|-------|
| 336 |   | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 7.268 |   |                                                                 |   |   |   |       |
| 337 |   | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 8.413 |   | 95% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 9.579 |
| 338 |   | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 11.2  |   | 99% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 14.37 |
| 339 |   |                                                                                                                                          |   |   |       |   |                                                                 |   |   |   |       |
| 340 |   | <b>Suggested UCL to Use</b>                                                                                                              |   |   |       |   |                                                                 |   |   |   |       |
| 341 |   | 95% Student's-t UCL                                                                                                                      |   |   | 7.369 |   |                                                                 |   |   |   |       |
| 342 |   |                                                                                                                                          |   |   |       |   |                                                                 |   |   |   |       |
| 343 |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |       |   |                                                                 |   |   |   |       |
| 344 |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |       |   |                                                                 |   |   |   |       |
| 345 |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |       |   |                                                                 |   |   |   |       |
| 346 |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |       |   |                                                                 |   |   |   |       |
| 347 |   |                                                                                                                                          |   |   |       |   |                                                                 |   |   |   |       |
| 348 |   |                                                                                                                                          |   |   |       |   |                                                                 |   |   |   |       |
| 349 |   | <b>Result (eu7_cobalt)</b>                                                                                                               |   |   |       |   |                                                                 |   |   |   |       |
| 350 |   |                                                                                                                                          |   |   |       |   |                                                                 |   |   |   |       |
| 351 |   | <b>General Statistics</b>                                                                                                                |   |   |       |   |                                                                 |   |   |   |       |
| 352 |   | Total Number of Observations                                                                                                             |   |   | 12    |   | Number of Distinct Observations                                 |   |   |   | 12    |
| 353 |   |                                                                                                                                          |   |   |       |   | Number of Missing Observations                                  |   |   |   | 0     |
| 354 |   | Minimum                                                                                                                                  |   |   | 1.51  |   | Mean                                                            |   |   |   | 7.475 |
| 355 |   | Maximum                                                                                                                                  |   |   | 29.7  |   | Median                                                          |   |   |   | 5.6   |
| 356 |   | SD                                                                                                                                       |   |   | 7.504 |   | Std. Error of Mean                                              |   |   |   | 2.166 |
| 357 |   | Coefficient of Variation                                                                                                                 |   |   | 1.004 |   | Skewness                                                        |   |   |   | 2.707 |
| 358 |   |                                                                                                                                          |   |   |       |   |                                                                 |   |   |   |       |
| 359 |   | <b>Normal GOF Test</b>                                                                                                                   |   |   |       |   |                                                                 |   |   |   |       |
| 360 |   | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.668 |   | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |       |
| 361 |   | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.859 |   | Data Not Normal at 5% Significance Level                        |   |   |   |       |
| 362 |   | Lilliefors Test Statistic                                                                                                                |   |   | 0.27  |   | <b>Lilliefors GOF Test</b>                                      |   |   |   |       |
| 363 |   | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.243 |   | Data Not Normal at 5% Significance Level                        |   |   |   |       |
| 364 |   | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |       |   |                                                                 |   |   |   |       |
| 365 |   |                                                                                                                                          |   |   |       |   |                                                                 |   |   |   |       |
| 366 |   | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |       |   |                                                                 |   |   |   |       |
| 367 |   | <b>95% Normal UCL</b>                                                                                                                    |   |   |       |   | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |   |       |
| 368 |   | 95% Student's-t UCL                                                                                                                      |   |   | 11.37 |   | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |   | 12.85 |
| 369 |   |                                                                                                                                          |   |   |       |   | 95% Modified-t UCL (Johnson-1978)                               |   |   |   | 11.65 |
| 370 |   |                                                                                                                                          |   |   |       |   |                                                                 |   |   |   |       |
| 371 |   | <b>Gamma GOF Test</b>                                                                                                                    |   |   |       |   |                                                                 |   |   |   |       |
| 372 |   | A-D Test Statistic                                                                                                                       |   |   | 0.493 |   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |   |       |
| 373 |   | 5% A-D Critical Value                                                                                                                    |   |   | 0.743 |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |       |
| 374 |   | K-S Test Statistic                                                                                                                       |   |   | 0.177 |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |   |       |
| 375 |   | 5% K-S Critical Value                                                                                                                    |   |   | 0.249 |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |       |
| 376 |   | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |       |   |                                                                 |   |   |   |       |
| 377 |   |                                                                                                                                          |   |   |       |   |                                                                 |   |   |   |       |
| 378 |   | <b>Gamma Statistics</b>                                                                                                                  |   |   |       |   |                                                                 |   |   |   |       |
| 379 |   | k hat (MLE)                                                                                                                              |   |   | 1.786 |   | k star (bias corrected MLE)                                     |   |   |   | 1.395 |
| 380 |   | Theta hat (MLE)                                                                                                                          |   |   | 4.185 |   | Theta star (bias corrected MLE)                                 |   |   |   | 5.358 |
| 381 |   | nu hat (MLE)                                                                                                                             |   |   | 42.87 |   | nu star (bias corrected)                                        |   |   |   | 33.48 |
| 382 |   | MLE Mean (bias corrected)                                                                                                                |   |   | 7.475 |   | MLE Sd (bias corrected)                                         |   |   |   | 6.329 |
| 383 |   |                                                                                                                                          |   |   |       |   | Approximate Chi Square Value (0.05)                             |   |   |   | 21.25 |
| 384 |   | Adjusted Level of Significance                                                                                                           |   |   | 0.029 |   | Adjusted Chi Square Value                                       |   |   |   | 19.78 |
| 385 |   |                                                                                                                                          |   |   |       |   |                                                                 |   |   |   |       |
| 386 |   | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |       |   |                                                                 |   |   |   |       |
| 387 |   | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   |   | 11.78 |   | 95% Adjusted Gamma UCL (use when n<50)                          |   |   |   | 12.66 |
| 388 |   |                                                                                                                                          |   |   |       |   |                                                                 |   |   |   |       |
| 389 |   | <b>Lognormal GOF Test</b>                                                                                                                |   |   |       |   |                                                                 |   |   |   |       |
| 390 |   | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.964 |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |   |       |
| 391 |   | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.859 |   | Data appear Lognormal at 5% Significance Level                  |   |   |   |       |
| 392 |   | Lilliefors Test Statistic                                                                                                                |   |   | 0.139 |   | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |   |       |
| 393 |   | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.243 |   | Data appear Lognormal at 5% Significance Level                  |   |   |   |       |
| 394 |   | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |       |   |                                                                 |   |   |   |       |
| 395 |   |                                                                                                                                          |   |   |       |   |                                                                 |   |   |   |       |
| 396 |   | <b>Lognormal Statistics</b>                                                                                                              |   |   |       |   |                                                                 |   |   |   |       |
| 397 |   | Minimum of Logged Data                                                                                                                   |   |   | 0.412 |   | Mean of logged Data                                             |   |   |   | 1.706 |
| 398 |   | Maximum of Logged Data                                                                                                                   |   |   | 3.391 |   | SD of logged Data                                               |   |   |   | 0.775 |
| 399 |   |                                                                                                                                          |   |   |       |   |                                                                 |   |   |   |       |
| 400 |   | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |       |   |                                                                 |   |   |   |       |
| 401 |   | 95% H-UCL                                                                                                                                |   |   | 13.44 |   | 90% Chebyshev (MVUE) UCL                                        |   |   |   | 12.3  |
| 402 |   | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 14.6  |   | 97.5% Chebyshev (MVUE) UCL                                      |   |   |   | 17.8  |

| A   | B                                                                                                                                         | C | D | E      | F                                                               | G | H | I     | J | K | L |  |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------------------|---|---|-------|---|---|---|--|
| 403 | 99% Chebyshev (MVUE) UCL                                                                                                                  |   |   | 24.08  |                                                                 |   |   |       |   |   |   |  |
| 404 |                                                                                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 405 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                     |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 406 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 407 |                                                                                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 408 | <b>Nonparametric Distribution Free UCLs</b>                                                                                               |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 409 | 95% CLT UCL                                                                                                                               |   |   | 11.04  | 95% Jackknife UCL                                               |   |   | 11.37 |   |   |   |  |
| 410 | 95% Standard Bootstrap UCL                                                                                                                |   |   | 10.93  | 95% Bootstrap-t UCL                                             |   |   | 16.54 |   |   |   |  |
| 411 | 95% Hall's Bootstrap UCL                                                                                                                  |   |   | 25.8   | 95% Percentile Bootstrap UCL                                    |   |   | 11.28 |   |   |   |  |
| 412 | 95% BCA Bootstrap UCL                                                                                                                     |   |   | 12.88  |                                                                 |   |   |       |   |   |   |  |
| 413 | 90% Chebyshev(Mean, Sd) UCL                                                                                                               |   |   | 13.97  | 95% Chebyshev(Mean, Sd) UCL                                     |   |   | 16.92 |   |   |   |  |
| 414 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                             |   |   | 21     | 99% Chebyshev(Mean, Sd) UCL                                     |   |   | 29.03 |   |   |   |  |
| 415 |                                                                                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 416 | <b>Suggested UCL to Use</b>                                                                                                               |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 417 | 95% Adjusted Gamma UCL                                                                                                                    |   |   | 12.66  |                                                                 |   |   |       |   |   |   |  |
| 418 |                                                                                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 419 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 420 | Recommendations are based upon data size, data distribution, and skewness.                                                                |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 421 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 422 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 423 |                                                                                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 424 |                                                                                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 425 | <b>Result (eu7_iron)</b>                                                                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 426 |                                                                                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 427 | <b>General Statistics</b>                                                                                                                 |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 428 | Total Number of Observations                                                                                                              |   |   | 13     | Number of Distinct Observations                                 |   |   | 13    |   |   |   |  |
| 429 |                                                                                                                                           |   |   |        | Number of Missing Observations                                  |   |   | 0     |   |   |   |  |
| 430 | Minimum                                                                                                                                   |   |   | 14400  | Mean                                                            |   |   | 28831 |   |   |   |  |
| 431 | Maximum                                                                                                                                   |   |   | 48100  | Median                                                          |   |   | 25200 |   |   |   |  |
| 432 | SD                                                                                                                                        |   |   | 10675  | Std. Error of Mean                                              |   |   | 2961  |   |   |   |  |
| 433 | Coefficient of Variation                                                                                                                  |   |   | 0.37   | Skewness                                                        |   |   | 0.502 |   |   |   |  |
| 434 |                                                                                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 435 | <b>Normal GOF Test</b>                                                                                                                    |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 436 | Shapiro Wilk Test Statistic                                                                                                               |   |   | 0.938  | <b>Shapiro Wilk GOF Test</b>                                    |   |   |       |   |   |   |  |
| 437 | 5% Shapiro Wilk Critical Value                                                                                                            |   |   | 0.866  | Data appear Normal at 5% Significance Level                     |   |   |       |   |   |   |  |
| 438 | Lilliefors Test Statistic                                                                                                                 |   |   | 0.172  | <b>Lilliefors GOF Test</b>                                      |   |   |       |   |   |   |  |
| 439 | 5% Lilliefors Critical Value                                                                                                              |   |   | 0.234  | Data appear Normal at 5% Significance Level                     |   |   |       |   |   |   |  |
| 440 | <b>Data appear Normal at 5% Significance Level</b>                                                                                        |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 441 |                                                                                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 442 | <b>Assuming Normal Distribution</b>                                                                                                       |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 443 | <b>95% Normal UCL</b>                                                                                                                     |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |       |   |   |   |  |
| 444 | 95% Student's-t UCL                                                                                                                       |   |   | 34108  | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   | 34141 |   |   |   |  |
| 445 |                                                                                                                                           |   |   |        | 95% Modified-t UCL (Johnson-1978)                               |   |   | 34176 |   |   |   |  |
| 446 |                                                                                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 447 | <b>Gamma GOF Test</b>                                                                                                                     |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 448 | A-D Test Statistic                                                                                                                        |   |   | 0.276  | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |       |   |   |   |  |
| 449 | 5% A-D Critical Value                                                                                                                     |   |   | 0.735  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |  |
| 450 | K-S Test Statistic                                                                                                                        |   |   | 0.138  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |       |   |   |   |  |
| 451 | 5% K-S Critical Value                                                                                                                     |   |   | 0.237  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |  |
| 452 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                    |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 453 |                                                                                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 454 | <b>Gamma Statistics</b>                                                                                                                   |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 455 | k hat (MLE)                                                                                                                               |   |   | 7.963  | k star (bias corrected MLE)                                     |   |   | 6.177 |   |   |   |  |
| 456 | Theta hat (MLE)                                                                                                                           |   |   | 3620   | Theta star (bias corrected MLE)                                 |   |   | 4668  |   |   |   |  |
| 457 | nu hat (MLE)                                                                                                                              |   |   | 207    | nu star (bias corrected)                                        |   |   | 160.6 |   |   |   |  |
| 458 | MLE Mean (bias corrected)                                                                                                                 |   |   | 28831  | MLE Sd (bias corrected)                                         |   |   | 11600 |   |   |   |  |
| 459 |                                                                                                                                           |   |   |        | Approximate Chi Square Value (0.05)                             |   |   | 132.3 |   |   |   |  |
| 460 | Adjusted Level of Significance                                                                                                            |   |   | 0.0301 | Adjusted Chi Square Value                                       |   |   | 128.6 |   |   |   |  |
| 461 |                                                                                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 462 | <b>Assuming Gamma Distribution</b>                                                                                                        |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 463 | 95% Approximate Gamma UCL (use when n>=50))                                                                                               |   |   | 34998  | 95% Adjusted Gamma UCL (use when n<50)                          |   |   | 35993 |   |   |   |  |
| 464 |                                                                                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 465 | <b>Lognormal GOF Test</b>                                                                                                                 |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 466 | Shapiro Wilk Test Statistic                                                                                                               |   |   | 0.962  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |       |   |   |   |  |
| 467 | 5% Shapiro Wilk Critical Value                                                                                                            |   |   | 0.866  | Data appear Lognormal at 5% Significance Level                  |   |   |       |   |   |   |  |
| 468 | Lilliefors Test Statistic                                                                                                                 |   |   | 0.134  | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |       |   |   |   |  |
| 469 | 5% Lilliefors Critical Value                                                                                                              |   |   | 0.234  | Data appear Lognormal at 5% Significance Level                  |   |   |       |   |   |   |  |

| A   | B                                                                                                                                         | C      | D | E                                                               | F                                       | G | H | I | J | K | L |  |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------|--------|---|-----------------------------------------------------------------|-----------------------------------------|---|---|---|---|---|---|--|
| 470 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                     |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 471 |                                                                                                                                           |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 472 | <b>Lognormal Statistics</b>                                                                                                               |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 473 | Minimum of Logged Data                                                                                                                    | 9.575  |   | Mean of logged Data                                             | 10.21                                   |   |   |   |   |   |   |  |
| 474 | Maximum of Logged Data                                                                                                                    | 10.78  |   | SD of logged Data                                               | 0.375                                   |   |   |   |   |   |   |  |
| 475 |                                                                                                                                           |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 476 | <b>Assuming Lognormal Distribution</b>                                                                                                    |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 477 | 95% H-UCL                                                                                                                                 | 35953  |   | 90% Chebyshev (MVUE) UCL                                        | 37998                                   |   |   |   |   |   |   |  |
| 478 | 95% Chebyshev (MVUE) UCL                                                                                                                  | 42143  |   | 97.5% Chebyshev (MVUE) UCL                                      | 47895                                   |   |   |   |   |   |   |  |
| 479 | 99% Chebyshev (MVUE) UCL                                                                                                                  | 59194  |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 480 |                                                                                                                                           |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 481 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                     |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 482 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                          |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 483 |                                                                                                                                           |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 484 | <b>Nonparametric Distribution Free UCLs</b>                                                                                               |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 485 | 95% CLT UCL                                                                                                                               | 33701  |   | 95% Jackknife UCL                                               | 34108                                   |   |   |   |   |   |   |  |
| 486 | 95% Standard Bootstrap UCL                                                                                                                | 33613  |   | 95% Bootstrap-t UCL                                             | 35002                                   |   |   |   |   |   |   |  |
| 487 | 95% Hall's Bootstrap UCL                                                                                                                  | 34368  |   | 95% Percentile Bootstrap UCL                                    | 33492                                   |   |   |   |   |   |   |  |
| 488 | 95% BCA Bootstrap UCL                                                                                                                     | 33762  |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 489 | 90% Chebyshev(Mean, Sd) UCL                                                                                                               | 37713  |   | 95% Chebyshev(Mean, Sd) UCL                                     | 41736                                   |   |   |   |   |   |   |  |
| 490 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                             | 47320  |   | 99% Chebyshev(Mean, Sd) UCL                                     | 58289                                   |   |   |   |   |   |   |  |
| 491 |                                                                                                                                           |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 492 | <b>Suggested UCL to Use</b>                                                                                                               |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 493 | 95% Student's-t UCL                                                                                                                       | 34108  |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 494 |                                                                                                                                           |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 495 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 496 | Recommendations are based upon data size, data distribution, and skewness.                                                                |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 497 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 498 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 499 |                                                                                                                                           |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 500 |                                                                                                                                           |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 501 | <b>Result (eu7_manganese)</b>                                                                                                             |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 502 |                                                                                                                                           |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 503 | <b>General Statistics</b>                                                                                                                 |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 504 | Total Number of Observations                                                                                                              | 13     |   | Number of Distinct Observations                                 | 13                                      |   |   |   |   |   |   |  |
| 505 |                                                                                                                                           |        |   | Number of Missing Observations                                  | 0                                       |   |   |   |   |   |   |  |
| 506 | Minimum                                                                                                                                   | 165    |   | Mean                                                            | 1659                                    |   |   |   |   |   |   |  |
| 507 | Maximum                                                                                                                                   | 9030   |   | Median                                                          | 829                                     |   |   |   |   |   |   |  |
| 508 | SD                                                                                                                                        | 2356   |   | Std. Error of Mean                                              | 653.3                                   |   |   |   |   |   |   |  |
| 509 | Coefficient of Variation                                                                                                                  | 1.42   |   | Skewness                                                        | 2.936                                   |   |   |   |   |   |   |  |
| 510 |                                                                                                                                           |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 511 | <b>Normal GOF Test</b>                                                                                                                    |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 512 | Shapiro Wilk Test Statistic                                                                                                               | 0.604  |   | <b>Shapiro Wilk GOF Test</b>                                    |                                         |   |   |   |   |   |   |  |
| 513 | 5% Shapiro Wilk Critical Value                                                                                                            | 0.866  |   | Data Not Normal at 5% Significance Level                        |                                         |   |   |   |   |   |   |  |
| 514 | Lilliefors Test Statistic                                                                                                                 | 0.294  |   | <b>Lilliefors GOF Test</b>                                      |                                         |   |   |   |   |   |   |  |
| 515 | 5% Lilliefors Critical Value                                                                                                              | 0.234  |   | Data Not Normal at 5% Significance Level                        |                                         |   |   |   |   |   |   |  |
| 516 | <b>Data Not Normal at 5% Significance Level</b>                                                                                           |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 517 |                                                                                                                                           |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 518 | <b>Assuming Normal Distribution</b>                                                                                                       |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 519 | <b>95% Normal UCL</b>                                                                                                                     |        |   |                                                                 | <b>95% UCLs (Adjusted for Skewness)</b> |   |   |   |   |   |   |  |
| 520 | 95% Student's-t UCL                                                                                                                       | 2823   |   | 95% Adjusted-CLT UCL (Chen-1995)                                | 3302                                    |   |   |   |   |   |   |  |
| 521 |                                                                                                                                           |        |   | 95% Modified-t UCL (Johnson-1978)                               | 2912                                    |   |   |   |   |   |   |  |
| 522 |                                                                                                                                           |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 523 | <b>Gamma GOF Test</b>                                                                                                                     |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 524 | A-D Test Statistic                                                                                                                        | 0.573  |   | <b>Anderson-Darling Gamma GOF Test</b>                          |                                         |   |   |   |   |   |   |  |
| 525 | 5% A-D Critical Value                                                                                                                     | 0.759  |   | Detected data appear Gamma Distributed at 5% Significance Level |                                         |   |   |   |   |   |   |  |
| 526 | K-S Test Statistic                                                                                                                        | 0.22   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |                                         |   |   |   |   |   |   |  |
| 527 | 5% K-S Critical Value                                                                                                                     | 0.243  |   | Detected data appear Gamma Distributed at 5% Significance Level |                                         |   |   |   |   |   |   |  |
| 528 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                    |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 529 |                                                                                                                                           |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 530 | <b>Gamma Statistics</b>                                                                                                                   |        |   |                                                                 |                                         |   |   |   |   |   |   |  |
| 531 | k hat (MLE)                                                                                                                               | 0.979  |   | k star (bias corrected MLE)                                     | 0.804                                   |   |   |   |   |   |   |  |
| 532 | Theta hat (MLE)                                                                                                                           | 1695   |   | Theta star (bias corrected MLE)                                 | 2063                                    |   |   |   |   |   |   |  |
| 533 | nu hat (MLE)                                                                                                                              | 25.44  |   | nu star (bias corrected)                                        | 20.91                                   |   |   |   |   |   |   |  |
| 534 | MLE Mean (bias corrected)                                                                                                                 | 1659   |   | MLE Sd (bias corrected)                                         | 1850                                    |   |   |   |   |   |   |  |
| 535 |                                                                                                                                           |        |   | Approximate Chi Square Value (0.05)                             | 11.52                                   |   |   |   |   |   |   |  |
| 536 | Adjusted Level of Significance                                                                                                            | 0.0301 |   | Adjusted Chi Square Value                                       | 10.54                                   |   |   |   |   |   |   |  |

| A   | B                                                                                                                                         | C | D | E      | F                                                 | G                                      | H | I | J      | K    | L |  |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|---------------------------------------------------|----------------------------------------|---|---|--------|------|---|--|
| 537 |                                                                                                                                           |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 538 | <b>Assuming Gamma Distribution</b>                                                                                                        |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 539 | 95% Approximate Gamma UCL (use when n>=50)                                                                                                |   |   |        | 3010                                              | 95% Adjusted Gamma UCL (use when n<50) |   |   |        | 3290 |   |  |
| 540 |                                                                                                                                           |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 541 | <b>Lognormal GOF Test</b>                                                                                                                 |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 542 | Shapiro Wilk Test Statistic                                                                                                               |   |   | 0.967  | <b>Shapiro Wilk Lognormal GOF Test</b>            |                                        |   |   |        |      |   |  |
| 543 | 5% Shapiro Wilk Critical Value                                                                                                            |   |   | 0.866  | Data appear Lognormal at 5% Significance Level    |                                        |   |   |        |      |   |  |
| 544 | Lilliefors Test Statistic                                                                                                                 |   |   | 0.143  | <b>Lilliefors Lognormal GOF Test</b>              |                                        |   |   |        |      |   |  |
| 545 | 5% Lilliefors Critical Value                                                                                                              |   |   | 0.234  | Data appear Lognormal at 5% Significance Level    |                                        |   |   |        |      |   |  |
| 546 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                     |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 547 |                                                                                                                                           |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 548 | <b>Lognormal Statistics</b>                                                                                                               |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 549 | Minimum of Logged Data                                                                                                                    |   |   | 5.106  | Mean of logged Data                               |                                        |   |   | 6.822  |      |   |  |
| 550 | Maximum of Logged Data                                                                                                                    |   |   | 9.108  | SD of logged Data                                 |                                        |   |   | 1.089  |      |   |  |
| 551 |                                                                                                                                           |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 552 | <b>Assuming Lognormal Distribution</b>                                                                                                    |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 553 | 95% H-UCL                                                                                                                                 |   |   | 4267   | 90% Chebyshev (MVUE) UCL                          |                                        |   |   | 3087   |      |   |  |
| 554 | 95% Chebyshev (MVUE) UCL                                                                                                                  |   |   | 3780   | 97.5% Chebyshev (MVUE) UCL                        |                                        |   |   | 4742   |      |   |  |
| 555 | 99% Chebyshev (MVUE) UCL                                                                                                                  |   |   | 6633   |                                                   |                                        |   |   |        |      |   |  |
| 556 |                                                                                                                                           |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 557 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                     |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 558 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                          |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 559 |                                                                                                                                           |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 560 | <b>Nonparametric Distribution Free UCLs</b>                                                                                               |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 561 | 95% CLT UCL                                                                                                                               |   |   | 2733   | 95% Jackknife UCL                                 |                                        |   |   | 2823   |      |   |  |
| 562 | 95% Standard Bootstrap UCL                                                                                                                |   |   | 2681   | 95% Bootstrap-t UCL                               |                                        |   |   | 4807   |      |   |  |
| 563 | 95% Hall's Bootstrap UCL                                                                                                                  |   |   | 6606   | 95% Percentile Bootstrap UCL                      |                                        |   |   | 2767   |      |   |  |
| 564 | 95% BCA Bootstrap UCL                                                                                                                     |   |   | 3447   |                                                   |                                        |   |   |        |      |   |  |
| 565 | 90% Chebyshev(Mean, Sd) UCL                                                                                                               |   |   | 3619   | 95% Chebyshev(Mean, Sd) UCL                       |                                        |   |   | 4506   |      |   |  |
| 566 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                             |   |   | 5739   | 99% Chebyshev(Mean, Sd) UCL                       |                                        |   |   | 8159   |      |   |  |
| 567 |                                                                                                                                           |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 568 | <b>Suggested UCL to Use</b>                                                                                                               |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 569 | 95% Adjusted Gamma UCL                                                                                                                    |   |   | 3290   |                                                   |                                        |   |   |        |      |   |  |
| 570 |                                                                                                                                           |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 571 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 572 | Recommendations are based upon data size, data distribution, and skewness.                                                                |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 573 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 574 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 575 |                                                                                                                                           |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 576 | <b>Result (eu7_thallium)</b>                                                                                                              |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 577 |                                                                                                                                           |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 578 | <b>General Statistics</b>                                                                                                                 |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 579 | Total Number of Observations                                                                                                              |   |   | 12     | Number of Distinct Observations                   |                                        |   |   | 11     |      |   |  |
| 580 | Number of Detects                                                                                                                         |   |   | 9      | Number of Non-Detects                             |                                        |   |   | 3      |      |   |  |
| 581 | Number of Distinct Detects                                                                                                                |   |   | 8      | Number of Distinct Non-Detects                    |                                        |   |   | 3      |      |   |  |
| 582 | Minimum Detect                                                                                                                            |   |   | 0.086  | Minimum Non-Detect                                |                                        |   |   | 0.494  |      |   |  |
| 583 | Maximum Detect                                                                                                                            |   |   | 0.634  | Maximum Non-Detect                                |                                        |   |   | 0.979  |      |   |  |
| 584 | Variance Detects                                                                                                                          |   |   | 0.0371 | Percent Non-Detects                               |                                        |   |   | 25%    |      |   |  |
| 585 | Mean Detects                                                                                                                              |   |   | 0.247  | SD Detects                                        |                                        |   |   | 0.193  |      |   |  |
| 586 | Median Detects                                                                                                                            |   |   | 0.18   | CV Detects                                        |                                        |   |   | 0.781  |      |   |  |
| 587 | Skewness Detects                                                                                                                          |   |   | 1.468  | Kurtosis Detects                                  |                                        |   |   | 0.989  |      |   |  |
| 588 | Mean of Logged Detects                                                                                                                    |   |   | -1.627 | SD of Logged Detects                              |                                        |   |   | 0.687  |      |   |  |
| 589 |                                                                                                                                           |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 590 | <b>Normal GOF Test on Detects Only</b>                                                                                                    |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 591 | Shapiro Wilk Test Statistic                                                                                                               |   |   | 0.781  | <b>Shapiro Wilk GOF Test</b>                      |                                        |   |   |        |      |   |  |
| 592 | 5% Shapiro Wilk Critical Value                                                                                                            |   |   | 0.829  | Detected Data Not Normal at 5% Significance Level |                                        |   |   |        |      |   |  |
| 593 | Lilliefors Test Statistic                                                                                                                 |   |   | 0.302  | <b>Lilliefors GOF Test</b>                        |                                        |   |   |        |      |   |  |
| 594 | 5% Lilliefors Critical Value                                                                                                              |   |   | 0.274  | Detected Data Not Normal at 5% Significance Level |                                        |   |   |        |      |   |  |
| 595 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                  |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 596 |                                                                                                                                           |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 597 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                             |   |   |        |                                                   |                                        |   |   |        |      |   |  |
| 598 | KM Mean                                                                                                                                   |   |   | 0.23   | KM Standard Error of Mean                         |                                        |   |   | 0.0548 |      |   |  |
| 599 | KM SD                                                                                                                                     |   |   | 0.17   | 95% KM (BCA) UCL                                  |                                        |   |   | 0.331  |      |   |  |
| 600 | 95% KM (t) UCL                                                                                                                            |   |   | 0.328  | 95% KM (Percentile Bootstrap) UCL                 |                                        |   |   | 0.319  |      |   |  |
| 601 | 95% KM (z) UCL                                                                                                                            |   |   | 0.32   | 95% KM Bootstrap t UCL                            |                                        |   |   | 0.481  |      |   |  |
| 602 | 90% KM Chebyshev UCL                                                                                                                      |   |   | 0.394  | 95% KM Chebyshev UCL                              |                                        |   |   | 0.469  |      |   |  |
| 603 | 97.5% KM Chebyshev UCL                                                                                                                    |   |   | 0.572  | 99% KM Chebyshev UCL                              |                                        |   |   | 0.775  |      |   |  |

|     | A                                                                                                                         | B | C                                                   | D | E | F      | G                                                               | H                                              | I | J | K | L      |
|-----|---------------------------------------------------------------------------------------------------------------------------|---|-----------------------------------------------------|---|---|--------|-----------------------------------------------------------------|------------------------------------------------|---|---|---|--------|
| 604 |                                                                                                                           |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 605 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 606 |                                                                                                                           |   | A-D Test Statistic                                  |   |   | 0.564  |                                                                 | <b>Anderson-Darling GOF Test</b>               |   |   |   |        |
| 607 |                                                                                                                           |   | 5% A-D Critical Value                               |   |   | 0.729  | Detected data appear Gamma Distributed at 5% Significance Level |                                                |   |   |   |        |
| 608 |                                                                                                                           |   | K-S Test Statistic                                  |   |   | 0.26   | <b>Kolmogorov-Smirnov GOF</b>                                   |                                                |   |   |   |        |
| 609 |                                                                                                                           |   | 5% K-S Critical Value                               |   |   | 0.282  | Detected data appear Gamma Distributed at 5% Significance Level |                                                |   |   |   |        |
| 610 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                    |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 611 |                                                                                                                           |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 612 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 613 |                                                                                                                           |   | k hat (MLE)                                         |   |   | 2.354  |                                                                 | k star (bias corrected MLE)                    |   |   |   | 1.643  |
| 614 |                                                                                                                           |   | Theta hat (MLE)                                     |   |   | 0.105  |                                                                 | Theta star (bias corrected MLE)                |   |   |   | 0.15   |
| 615 |                                                                                                                           |   | nu hat (MLE)                                        |   |   | 42.36  |                                                                 | nu star (bias corrected)                       |   |   |   | 29.58  |
| 616 |                                                                                                                           |   | Mean (detects)                                      |   |   | 0.247  |                                                                 |                                                |   |   |   |        |
| 617 |                                                                                                                           |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 618 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 619 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 620 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 621 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 622 | This is especially true when the sample size is small.                                                                    |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 623 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 624 |                                                                                                                           |   | Minimum                                             |   |   | 0.086  |                                                                 | Mean                                           |   |   |   | 0.228  |
| 625 |                                                                                                                           |   | Maximum                                             |   |   | 0.634  |                                                                 | Median                                         |   |   |   | 0.169  |
| 626 |                                                                                                                           |   | SD                                                  |   |   | 0.168  |                                                                 | CV                                             |   |   |   | 0.737  |
| 627 |                                                                                                                           |   | k hat (MLE)                                         |   |   | 2.882  |                                                                 | k star (bias corrected MLE)                    |   |   |   | 2.217  |
| 628 |                                                                                                                           |   | Theta hat (MLE)                                     |   |   | 0.0791 |                                                                 | Theta star (bias corrected MLE)                |   |   |   | 0.103  |
| 629 |                                                                                                                           |   | nu hat (MLE)                                        |   |   | 69.17  |                                                                 | nu star (bias corrected)                       |   |   |   | 53.21  |
| 630 |                                                                                                                           |   | Adjusted Level of Significance ( $\beta$ )          |   |   | 0.029  |                                                                 |                                                |   |   |   |        |
| 631 |                                                                                                                           |   | Approximate Chi Square Value (53.21, $\alpha$ )     |   |   | 37.45  |                                                                 | Adjusted Chi Square Value (53.21, $\beta$ )    |   |   |   | 35.44  |
| 632 |                                                                                                                           |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )   |   |   | 0.324  |                                                                 | 95% Gamma Adjusted UCL (use when $n < 50$ )    |   |   |   | 0.342  |
| 633 |                                                                                                                           |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 634 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 635 |                                                                                                                           |   | Mean (KM)                                           |   |   | 0.23   |                                                                 | SD (KM)                                        |   |   |   | 0.17   |
| 636 |                                                                                                                           |   | Variance (KM)                                       |   |   | 0.0288 |                                                                 | SE of Mean (KM)                                |   |   |   | 0.0548 |
| 637 |                                                                                                                           |   | k hat (KM)                                          |   |   | 1.837  |                                                                 | k star (KM)                                    |   |   |   | 1.433  |
| 638 |                                                                                                                           |   | nu hat (KM)                                         |   |   | 44.09  |                                                                 | nu star (KM)                                   |   |   |   | 34.4   |
| 639 |                                                                                                                           |   | theta hat (KM)                                      |   |   | 0.125  |                                                                 | theta star (KM)                                |   |   |   | 0.16   |
| 640 |                                                                                                                           |   | 80% gamma percentile (KM)                           |   |   | 0.357  |                                                                 | 90% gamma percentile (KM)                      |   |   |   | 0.484  |
| 641 |                                                                                                                           |   | 95% gamma percentile (KM)                           |   |   | 0.608  |                                                                 | 99% gamma percentile (KM)                      |   |   |   | 0.888  |
| 642 |                                                                                                                           |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 643 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 644 |                                                                                                                           |   | Approximate Chi Square Value (34.40, $\alpha$ )     |   |   | 21.99  |                                                                 | Adjusted Chi Square Value (34.40, $\beta$ )    |   |   |   | 20.48  |
| 645 |                                                                                                                           |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ ) |   |   | 0.36   |                                                                 | 95% Gamma Adjusted KM-UCL (use when $n < 50$ ) |   |   |   | 0.386  |
| 646 |                                                                                                                           |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 647 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 648 |                                                                                                                           |   | Shapiro Wilk Test Statistic                         |   |   | 0.915  |                                                                 | <b>Shapiro Wilk GOF Test</b>                   |   |   |   |        |
| 649 |                                                                                                                           |   | 5% Shapiro Wilk Critical Value                      |   |   | 0.829  | Detected Data appear Lognormal at 5% Significance Level         |                                                |   |   |   |        |
| 650 |                                                                                                                           |   | Lilliefors Test Statistic                           |   |   | 0.218  | <b>Lilliefors GOF Test</b>                                      |                                                |   |   |   |        |
| 651 |                                                                                                                           |   | 5% Lilliefors Critical Value                        |   |   | 0.274  | Detected Data appear Lognormal at 5% Significance Level         |                                                |   |   |   |        |
| 652 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                            |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 653 |                                                                                                                           |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 654 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 655 |                                                                                                                           |   | Mean in Original Scale                              |   |   | 0.226  |                                                                 | Mean in Log Scale                              |   |   |   | -1.671 |
| 656 |                                                                                                                           |   | SD in Original Scale                                |   |   | 0.168  |                                                                 | SD in Log Scale                                |   |   |   | 0.593  |
| 657 |                                                                                                                           |   | 95% t UCL (assumes normality of ROS data)           |   |   | 0.314  |                                                                 | 95% Percentile Bootstrap UCL                   |   |   |   | 0.309  |
| 658 |                                                                                                                           |   | 95% BCA Bootstrap UCL                               |   |   | 0.341  |                                                                 | 95% Bootstrap t UCL                            |   |   |   | 0.498  |
| 659 |                                                                                                                           |   | 95% H-UCL (Log ROS)                                 |   |   | 0.336  |                                                                 |                                                |   |   |   |        |
| 660 |                                                                                                                           |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 661 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 662 |                                                                                                                           |   | KM Mean (logged)                                    |   |   | -1.682 |                                                                 | KM Geo Mean                                    |   |   |   | 0.186  |
| 663 |                                                                                                                           |   | KM SD (logged)                                      |   |   | 0.616  |                                                                 | 95% Critical H Value (KM-Log)                  |   |   |   | 2.293  |
| 664 |                                                                                                                           |   | KM Standard Error of Mean (logged)                  |   |   | 0.204  |                                                                 | 95% H-UCL (KM -Log)                            |   |   |   | 0.344  |
| 665 |                                                                                                                           |   | KM SD (logged)                                      |   |   | 0.616  |                                                                 | 95% Critical H Value (KM-Log)                  |   |   |   | 2.293  |
| 666 |                                                                                                                           |   | KM Standard Error of Mean (logged)                  |   |   | 0.204  |                                                                 |                                                |   |   |   |        |
| 667 |                                                                                                                           |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 668 | <b>DL/2 Statistics</b>                                                                                                    |   |                                                     |   |   |        |                                                                 |                                                |   |   |   |        |
| 669 | <b>DL/2 Normal</b>                                                                                                        |   |                                                     |   |   |        | <b>DL/2 Log-Transformed</b>                                     |                                                |   |   |   |        |
| 670 |                                                                                                                           |   | Mean in Original Scale                              |   |   | 0.267  |                                                                 | Mean in Log Scale                              |   |   |   | -1.511 |

| A   | B                                                                                                                                        | C                                          | E | F      | G | H | I | J                                                               | K | L     |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|---|--------|---|---|---|-----------------------------------------------------------------|---|-------|
| 671 |                                                                                                                                          | SD in Original Scale                       |   | 0.179  |   |   |   | SD in Log Scale                                                 |   | 0.644 |
| 672 |                                                                                                                                          | 95% t UCL (Assumes normality)              |   | 0.36   |   |   |   | 95% H-Stat UCL                                                  |   | 0.427 |
| 673 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |                                            |   |        |   |   |   |                                                                 |   |       |
| 674 |                                                                                                                                          |                                            |   |        |   |   |   |                                                                 |   |       |
| 675 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |                                            |   |        |   |   |   |                                                                 |   |       |
| 676 | <b>Detected Data appear Gamma Distributed at 5% Significance Level</b>                                                                   |                                            |   |        |   |   |   |                                                                 |   |       |
| 677 |                                                                                                                                          |                                            |   |        |   |   |   |                                                                 |   |       |
| 678 | <b>Suggested UCL to Use</b>                                                                                                              |                                            |   |        |   |   |   |                                                                 |   |       |
| 679 |                                                                                                                                          | 95% KM Adjusted Gamma UCL                  |   | 0.386  |   |   |   | 95% GROS Adjusted Gamma UCL                                     |   | 0.342 |
| 680 |                                                                                                                                          |                                            |   |        |   |   |   |                                                                 |   |       |
| 681 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |                                            |   |        |   |   |   |                                                                 |   |       |
| 682 | Recommendations are based upon data size, data distribution, and skewness.                                                               |                                            |   |        |   |   |   |                                                                 |   |       |
| 683 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |                                            |   |        |   |   |   |                                                                 |   |       |
| 684 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |                                            |   |        |   |   |   |                                                                 |   |       |
| 685 |                                                                                                                                          |                                            |   |        |   |   |   |                                                                 |   |       |
| 686 |                                                                                                                                          |                                            |   |        |   |   |   |                                                                 |   |       |
| 687 | <b>Result (eu7_zinc)</b>                                                                                                                 |                                            |   |        |   |   |   |                                                                 |   |       |
| 688 |                                                                                                                                          |                                            |   |        |   |   |   |                                                                 |   |       |
| 689 | <b>General Statistics</b>                                                                                                                |                                            |   |        |   |   |   |                                                                 |   |       |
| 690 |                                                                                                                                          | Total Number of Observations               |   | 13     |   |   |   | Number of Distinct Observations                                 |   | 13    |
| 691 |                                                                                                                                          |                                            |   |        |   |   |   | Number of Missing Observations                                  |   | 0     |
| 692 |                                                                                                                                          | Minimum                                    |   | 74.3   |   |   |   | Mean                                                            |   | 1135  |
| 693 |                                                                                                                                          | Maximum                                    |   | 5410   |   |   |   | Median                                                          |   | 540   |
| 694 |                                                                                                                                          | SD                                         |   | 1456   |   |   |   | Std. Error of Mean                                              |   | 403.9 |
| 695 |                                                                                                                                          | Coefficient of Variation                   |   | 1.283  |   |   |   | Skewness                                                        |   | 2.489 |
| 696 |                                                                                                                                          |                                            |   |        |   |   |   |                                                                 |   |       |
| 697 | <b>Normal GOF Test</b>                                                                                                                   |                                            |   |        |   |   |   |                                                                 |   |       |
| 698 |                                                                                                                                          | Shapiro Wilk Test Statistic                |   | 0.672  |   |   |   | <b>Shapiro Wilk GOF Test</b>                                    |   |       |
| 699 |                                                                                                                                          | 5% Shapiro Wilk Critical Value             |   | 0.866  |   |   |   | Data Not Normal at 5% Significance Level                        |   |       |
| 700 |                                                                                                                                          | Lilliefors Test Statistic                  |   | 0.322  |   |   |   | <b>Lilliefors GOF Test</b>                                      |   |       |
| 701 |                                                                                                                                          | 5% Lilliefors Critical Value               |   | 0.234  |   |   |   | Data Not Normal at 5% Significance Level                        |   |       |
| 702 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |                                            |   |        |   |   |   |                                                                 |   |       |
| 703 |                                                                                                                                          |                                            |   |        |   |   |   |                                                                 |   |       |
| 704 | <b>Assuming Normal Distribution</b>                                                                                                      |                                            |   |        |   |   |   |                                                                 |   |       |
| 705 |                                                                                                                                          | <b>95% Normal UCL</b>                      |   |        |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |       |
| 706 |                                                                                                                                          | 95% Student's-t UCL                        |   | 1855   |   |   |   | 95% Adjusted-CLT UCL (Chen-1995)                                |   | 2097  |
| 707 |                                                                                                                                          |                                            |   |        |   |   |   | 95% Modified-t UCL (Johnson-1978)                               |   | 1901  |
| 708 |                                                                                                                                          |                                            |   |        |   |   |   |                                                                 |   |       |
| 709 | <b>Gamma GOF Test</b>                                                                                                                    |                                            |   |        |   |   |   |                                                                 |   |       |
| 710 |                                                                                                                                          | A-D Test Statistic                         |   | 0.48   |   |   |   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |       |
| 711 |                                                                                                                                          | 5% A-D Critical Value                      |   | 0.757  |   |   |   | Detected data appear Gamma Distributed at 5% Significance Level |   |       |
| 712 |                                                                                                                                          | K-S Test Statistic                         |   | 0.209  |   |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |       |
| 713 |                                                                                                                                          | 5% K-S Critical Value                      |   | 0.243  |   |   |   | Detected data appear Gamma Distributed at 5% Significance Level |   |       |
| 714 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |                                            |   |        |   |   |   |                                                                 |   |       |
| 715 |                                                                                                                                          |                                            |   |        |   |   |   |                                                                 |   |       |
| 716 | <b>Gamma Statistics</b>                                                                                                                  |                                            |   |        |   |   |   |                                                                 |   |       |
| 717 |                                                                                                                                          | k hat (MLE)                                |   | 1.024  |   |   |   | k star (bias corrected MLE)                                     |   | 0.839 |
| 718 |                                                                                                                                          | Theta hat (MLE)                            |   | 1108   |   |   |   | Theta star (bias corrected MLE)                                 |   | 1352  |
| 719 |                                                                                                                                          | nu hat (MLE)                               |   | 26.64  |   |   |   | nu star (bias corrected)                                        |   | 21.82 |
| 720 |                                                                                                                                          | MLE Mean (bias corrected)                  |   | 1135   |   |   |   | MLE Sd (bias corrected)                                         |   | 1239  |
| 721 |                                                                                                                                          |                                            |   |        |   |   |   | Approximate Chi Square Value (0.05)                             |   | 12.21 |
| 722 |                                                                                                                                          | Adjusted Level of Significance             |   | 0.0301 |   |   |   | Adjusted Chi Square Value                                       |   | 11.19 |
| 723 |                                                                                                                                          |                                            |   |        |   |   |   |                                                                 |   |       |
| 724 | <b>Assuming Gamma Distribution</b>                                                                                                       |                                            |   |        |   |   |   |                                                                 |   |       |
| 725 |                                                                                                                                          | 95% Approximate Gamma UCL (use when n>=50) |   | 2029   |   |   |   | 95% Adjusted Gamma UCL (use when n<50)                          |   | 2213  |
| 726 |                                                                                                                                          |                                            |   |        |   |   |   |                                                                 |   |       |
| 727 | <b>Lognormal GOF Test</b>                                                                                                                |                                            |   |        |   |   |   |                                                                 |   |       |
| 728 |                                                                                                                                          | Shapiro Wilk Test Statistic                |   | 0.98   |   |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |       |
| 729 |                                                                                                                                          | 5% Shapiro Wilk Critical Value             |   | 0.866  |   |   |   | Data appear Lognormal at 5% Significance Level                  |   |       |
| 730 |                                                                                                                                          | Lilliefors Test Statistic                  |   | 0.137  |   |   |   | <b>Lilliefors Lognormal GOF Test</b>                            |   |       |
| 731 |                                                                                                                                          | 5% Lilliefors Critical Value               |   | 0.234  |   |   |   | Data appear Lognormal at 5% Significance Level                  |   |       |
| 732 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |                                            |   |        |   |   |   |                                                                 |   |       |
| 733 |                                                                                                                                          |                                            |   |        |   |   |   |                                                                 |   |       |
| 734 | <b>Lognormal Statistics</b>                                                                                                              |                                            |   |        |   |   |   |                                                                 |   |       |
| 735 |                                                                                                                                          | Minimum of Logged Data                     |   | 4.308  |   |   |   | Mean of logged Data                                             |   | 6.472 |
| 736 |                                                                                                                                          | Maximum of Logged Data                     |   | 8.596  |   |   |   | SD of logged Data                                               |   | 1.102 |
| 737 |                                                                                                                                          |                                            |   |        |   |   |   |                                                                 |   |       |

|     | A                                                                                                                                         | B | C | D | E                             | F    | G | H | I | J                            | K    | L |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|-------------------------------|------|---|---|---|------------------------------|------|---|
| 738 | <b>Assuming Lognormal Distribution</b>                                                                                                    |   |   |   |                               |      |   |   |   |                              |      |   |
| 739 |                                                                                                                                           |   |   |   | 95% H-UCL                     | 3109 |   |   |   | 90% Chebyshev (MVUE) UCL     | 2217 |   |
| 740 |                                                                                                                                           |   |   |   | 95% Chebyshev (MVUE) UCL      | 2718 |   |   |   | 97.5% Chebyshev (MVUE) UCL   | 3414 |   |
| 741 |                                                                                                                                           |   |   |   | 99% Chebyshev (MVUE) UCL      | 4780 |   |   |   |                              |      |   |
| 742 |                                                                                                                                           |   |   |   |                               |      |   |   |   |                              |      |   |
| 743 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                     |   |   |   |                               |      |   |   |   |                              |      |   |
| 744 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                          |   |   |   |                               |      |   |   |   |                              |      |   |
| 745 |                                                                                                                                           |   |   |   |                               |      |   |   |   |                              |      |   |
| 746 | <b>Nonparametric Distribution Free UCLs</b>                                                                                               |   |   |   |                               |      |   |   |   |                              |      |   |
| 747 |                                                                                                                                           |   |   |   | 95% CLT UCL                   | 1799 |   |   |   | 95% Jackknife UCL            | 1855 |   |
| 748 |                                                                                                                                           |   |   |   | 95% Standard Bootstrap UCL    | 1770 |   |   |   | 95% Bootstrap-t UCL          | 3301 |   |
| 749 |                                                                                                                                           |   |   |   | 95% Hall's Bootstrap UCL      | 4800 |   |   |   | 95% Percentile Bootstrap UCL | 1822 |   |
| 750 |                                                                                                                                           |   |   |   | 95% BCA Bootstrap UCL         | 2146 |   |   |   |                              |      |   |
| 751 |                                                                                                                                           |   |   |   | 90% Chebyshev(Mean, Sd) UCL   | 2347 |   |   |   | 95% Chebyshev(Mean, Sd) UCL  | 2896 |   |
| 752 |                                                                                                                                           |   |   |   | 97.5% Chebyshev(Mean, Sd) UCL | 3657 |   |   |   | 99% Chebyshev(Mean, Sd) UCL  | 5154 |   |
| 753 |                                                                                                                                           |   |   |   |                               |      |   |   |   |                              |      |   |
| 754 | <b>Suggested UCL to Use</b>                                                                                                               |   |   |   |                               |      |   |   |   |                              |      |   |
| 755 |                                                                                                                                           |   |   |   | 95% Adjusted Gamma UCL        | 2213 |   |   |   |                              |      |   |
| 756 |                                                                                                                                           |   |   |   |                               |      |   |   |   |                              |      |   |
| 757 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |   |   |   |                               |      |   |   |   |                              |      |   |
| 758 | Recommendations are based upon data size, data distribution, and skewness.                                                                |   |   |   |                               |      |   |   |   |                              |      |   |
| 759 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |   |   |   |                               |      |   |   |   |                              |      |   |
| 760 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |   |   |   |                               |      |   |   |   |                              |      |   |
| 761 |                                                                                                                                           |   |   |   |                               |      |   |   |   |                              |      |   |

|    | A                                                                                                                                 | B | C                              | D      | E | F                                                    | G | H | I      | J | K | L |
|----|-----------------------------------------------------------------------------------------------------------------------------------|---|--------------------------------|--------|---|------------------------------------------------------|---|---|--------|---|---|---|
| 1  | <b>UCL Statistics for Data Sets with Non-Detects</b>                                                                              |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 2  |                                                                                                                                   |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 3  | User Selected Options                                                                                                             |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 4  | Date/Time of Computation                                                                                                          |   | ProUCL 5.112/4/2017 3:22:53 PM |        |   |                                                      |   |   |        |   |   |   |
| 5  | From File                                                                                                                         |   | BPMD_HHRA_FishInput_v3.xls     |        |   |                                                      |   |   |        |   |   |   |
| 6  | Full Precision                                                                                                                    |   | OFF                            |        |   |                                                      |   |   |        |   |   |   |
| 7  | Confidence Coefficient                                                                                                            |   | 95%                            |        |   |                                                      |   |   |        |   |   |   |
| 8  | Number of Bootstrap Operations                                                                                                    |   | 2000                           |        |   |                                                      |   |   |        |   |   |   |
| 9  |                                                                                                                                   |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 10 | <b>Result (eu8_aluminum)</b>                                                                                                      |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 11 |                                                                                                                                   |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 12 | <b>General Statistics</b>                                                                                                         |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 13 | Total Number of Observations                                                                                                      |   |                                | 8      |   | Number of Distinct Observations                      |   |   | 8      |   |   |   |
| 14 | Number of Detects                                                                                                                 |   |                                | 0      |   | Number of Non-Detects                                |   |   | 8      |   |   |   |
| 15 | Number of Distinct Detects                                                                                                        |   |                                | 0      |   | Number of Distinct Non-Detects                       |   |   | 8      |   |   |   |
| 16 |                                                                                                                                   |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 17 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 18 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>          |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 19 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b> |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 20 |                                                                                                                                   |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 21 | <b>The data set for variable Result (eu8_aluminum) was not processed!</b>                                                         |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 22 |                                                                                                                                   |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 23 |                                                                                                                                   |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 24 | <b>Result (eu8_antimony)</b>                                                                                                      |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 25 |                                                                                                                                   |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 26 | <b>General Statistics</b>                                                                                                         |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 27 | Total Number of Observations                                                                                                      |   |                                | 8      |   | Number of Distinct Observations                      |   |   | 8      |   |   |   |
| 28 | Number of Detects                                                                                                                 |   |                                | 0      |   | Number of Non-Detects                                |   |   | 8      |   |   |   |
| 29 | Number of Distinct Detects                                                                                                        |   |                                | 0      |   | Number of Distinct Non-Detects                       |   |   | 8      |   |   |   |
| 30 |                                                                                                                                   |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 31 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 32 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>          |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 33 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b> |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 34 |                                                                                                                                   |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 35 | <b>The data set for variable Result (eu8_antimony) was not processed!</b>                                                         |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 36 |                                                                                                                                   |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 37 |                                                                                                                                   |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 38 | <b>Result (eu8_arsenic)</b>                                                                                                       |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 39 |                                                                                                                                   |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 40 | <b>General Statistics</b>                                                                                                         |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 41 | Total Number of Observations                                                                                                      |   |                                | 8      |   | Number of Distinct Observations                      |   |   | 8      |   |   |   |
| 42 | Number of Detects                                                                                                                 |   |                                | 7      |   | Number of Non-Detects                                |   |   | 1      |   |   |   |
| 43 | Number of Distinct Detects                                                                                                        |   |                                | 7      |   | Number of Distinct Non-Detects                       |   |   | 1      |   |   |   |
| 44 | Minimum Detect                                                                                                                    |   |                                | 0.0632 |   | Minimum Non-Detect                                   |   |   | 0.0607 |   |   |   |
| 45 | Maximum Detect                                                                                                                    |   |                                | 0.546  |   | Maximum Non-Detect                                   |   |   | 0.0607 |   |   |   |
| 46 | Variance Detects                                                                                                                  |   |                                | 0.04   |   | Percent Non-Detects                                  |   |   | 12.5%  |   |   |   |
| 47 | Mean Detects                                                                                                                      |   |                                | 0.323  |   | SD Detects                                           |   |   | 0.2    |   |   |   |
| 48 | Median Detects                                                                                                                    |   |                                | 0.301  |   | CV Detects                                           |   |   | 0.62   |   |   |   |
| 49 | Skewness Detects                                                                                                                  |   |                                | -0.326 |   | Kurtosis Detects                                     |   |   | -1.731 |   |   |   |
| 50 | Mean of Logged Detects                                                                                                            |   |                                | -1.403 |   | SD of Logged Detects                                 |   |   | 0.905  |   |   |   |
| 51 |                                                                                                                                   |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 52 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                        |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 53 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                            |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 54 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                               |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 55 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                    |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 56 |                                                                                                                                   |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 57 | <b>Normal GOF Test on Detects Only</b>                                                                                            |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 58 | Shapiro Wilk Test Statistic                                                                                                       |   |                                | 0.88   |   | <b>Shapiro Wilk GOF Test</b>                         |   |   |        |   |   |   |
| 59 | 5% Shapiro Wilk Critical Value                                                                                                    |   |                                | 0.803  |   | Detected Data appear Normal at 5% Significance Level |   |   |        |   |   |   |
| 60 | Lilliefors Test Statistic                                                                                                         |   |                                | 0.218  |   | <b>Lilliefors GOF Test</b>                           |   |   |        |   |   |   |
| 61 | 5% Lilliefors Critical Value                                                                                                      |   |                                | 0.304  |   | Detected Data appear Normal at 5% Significance Level |   |   |        |   |   |   |
| 62 | <b>Detected Data appear Normal at 5% Significance Level</b>                                                                       |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 63 |                                                                                                                                   |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 64 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                     |   |                                |        |   |                                                      |   |   |        |   |   |   |
| 65 | KM Mean                                                                                                                           |   |                                | 0.29   |   | KM Standard Error of Mean                            |   |   | 0.0739 |   |   |   |
| 66 | KM SD                                                                                                                             |   |                                | 0.194  |   | 95% KM (BCA) UCL                                     |   |   | 0.388  |   |   |   |
| 67 | 95% KM (t) UCL                                                                                                                    |   |                                | 0.43   |   | 95% KM (Percentile Bootstrap) UCL                    |   |   | 0.402  |   |   |   |

|     | A                                                                                                                         | B | C | D | E                                                   | F      | G                                                               | H | I | J                                              | K | L      |
|-----|---------------------------------------------------------------------------------------------------------------------------|---|---|---|-----------------------------------------------------|--------|-----------------------------------------------------------------|---|---|------------------------------------------------|---|--------|
| 68  |                                                                                                                           |   |   |   | 95% KM (z) UCL                                      | 0.412  |                                                                 |   |   | 95% KM Bootstrap t UCL                         |   | 0.429  |
| 69  |                                                                                                                           |   |   |   | 90% KM Chebyshev UCL                                | 0.512  |                                                                 |   |   | 95% KM Chebyshev UCL                           |   | 0.612  |
| 70  |                                                                                                                           |   |   |   | 97.5% KM Chebyshev UCL                              | 0.752  |                                                                 |   |   | 99% KM Chebyshev UCL                           |   | 1.025  |
| 71  |                                                                                                                           |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 72  | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 73  |                                                                                                                           |   |   |   | A-D Test Statistic                                  | 0.597  |                                                                 |   |   | <b>Anderson-Darling GOF Test</b>               |   |        |
| 74  |                                                                                                                           |   |   |   | 5% A-D Critical Value                               | 0.715  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |                                                |   |        |
| 75  |                                                                                                                           |   |   |   | K-S Test Statistic                                  | 0.24   | <b>Kolmogorov-Smirnov GOF</b>                                   |   |   |                                                |   |        |
| 76  |                                                                                                                           |   |   |   | 5% K-S Critical Value                               | 0.315  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |                                                |   |        |
| 77  | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                    |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 78  |                                                                                                                           |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 79  | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 80  |                                                                                                                           |   |   |   | k hat (MLE)                                         | 1.991  |                                                                 |   |   | k star (bias corrected MLE)                    |   | 1.233  |
| 81  |                                                                                                                           |   |   |   | Theta hat (MLE)                                     | 0.162  |                                                                 |   |   | Theta star (bias corrected MLE)                |   | 0.262  |
| 82  |                                                                                                                           |   |   |   | nu hat (MLE)                                        | 27.88  |                                                                 |   |   | nu star (bias corrected)                       |   | 17.27  |
| 83  |                                                                                                                           |   |   |   | Mean (detects)                                      | 0.323  |                                                                 |   |   |                                                |   |        |
| 84  |                                                                                                                           |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 85  | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 86  | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 87  | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 88  | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 89  | This is especially true when the sample size is small.                                                                    |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 90  | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 91  |                                                                                                                           |   |   |   | Minimum                                             | 0.0158 |                                                                 |   |   | Mean                                           |   | 0.284  |
| 92  |                                                                                                                           |   |   |   | Maximum                                             | 0.546  |                                                                 |   |   | Median                                         |   | 0.292  |
| 93  |                                                                                                                           |   |   |   | SD                                                  | 0.215  |                                                                 |   |   | CV                                             |   | 0.755  |
| 94  |                                                                                                                           |   |   |   | k hat (MLE)                                         | 1.162  |                                                                 |   |   | k star (bias corrected MLE)                    |   | 0.81   |
| 95  |                                                                                                                           |   |   |   | Theta hat (MLE)                                     | 0.245  |                                                                 |   |   | Theta star (bias corrected MLE)                |   | 0.351  |
| 96  |                                                                                                                           |   |   |   | nu hat (MLE)                                        | 18.6   |                                                                 |   |   | nu star (bias corrected)                       |   | 12.96  |
| 97  |                                                                                                                           |   |   |   | Adjusted Level of Significance ( $\beta$ )          | 0.0195 |                                                                 |   |   |                                                |   |        |
| 98  |                                                                                                                           |   |   |   | Approximate Chi Square Value (12.96, $\alpha$ )     | 5.865  |                                                                 |   |   | Adjusted Chi Square Value (12.96, $\beta$ )    |   | 4.714  |
| 99  |                                                                                                                           |   |   |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )   | 0.628  |                                                                 |   |   | 95% Gamma Adjusted UCL (use when $n < 50$ )    |   | 0.782  |
| 100 |                                                                                                                           |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 101 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 102 |                                                                                                                           |   |   |   | Mean (KM)                                           | 0.29   |                                                                 |   |   | SD (KM)                                        |   | 0.194  |
| 103 |                                                                                                                           |   |   |   | Variance (KM)                                       | 0.0375 |                                                                 |   |   | SE of Mean (KM)                                |   | 0.0739 |
| 104 |                                                                                                                           |   |   |   | k hat (KM)                                          | 2.243  |                                                                 |   |   | k star (KM)                                    |   | 1.485  |
| 105 |                                                                                                                           |   |   |   | nu hat (KM)                                         | 35.89  |                                                                 |   |   | nu star (KM)                                   |   | 23.76  |
| 106 |                                                                                                                           |   |   |   | theta hat (KM)                                      | 0.129  |                                                                 |   |   | theta star (KM)                                |   | 0.195  |
| 107 |                                                                                                                           |   |   |   | 80% gamma percentile (KM)                           | 0.449  |                                                                 |   |   | 90% gamma percentile (KM)                      |   | 0.606  |
| 108 |                                                                                                                           |   |   |   | 95% gamma percentile (KM)                           | 0.758  |                                                                 |   |   | 99% gamma percentile (KM)                      |   | 1.101  |
| 109 |                                                                                                                           |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 110 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 111 |                                                                                                                           |   |   |   | Approximate Chi Square Value (23.76, $\alpha$ )     | 13.67  |                                                                 |   |   | Adjusted Chi Square Value (23.76, $\beta$ )    |   | 11.78  |
| 112 |                                                                                                                           |   |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ ) | 0.504  |                                                                 |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ ) |   | 0.585  |
| 113 |                                                                                                                           |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 114 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 115 |                                                                                                                           |   |   |   | Shapiro Wilk Test Statistic                         | 0.81   |                                                                 |   |   | <b>Shapiro Wilk GOF Test</b>                   |   |        |
| 116 |                                                                                                                           |   |   |   | 5% Shapiro Wilk Critical Value                      | 0.803  | Detected Data appear Lognormal at 5% Significance Level         |   |   |                                                |   |        |
| 117 |                                                                                                                           |   |   |   | Lilliefors Test Statistic                           | 0.277  | <b>Lilliefors GOF Test</b>                                      |   |   |                                                |   |        |
| 118 |                                                                                                                           |   |   |   | 5% Lilliefors Critical Value                        | 0.304  | Detected Data appear Lognormal at 5% Significance Level         |   |   |                                                |   |        |
| 119 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                            |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 120 |                                                                                                                           |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 121 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 122 |                                                                                                                           |   |   |   | Mean in Original Scale                              | 0.286  |                                                                 |   |   | Mean in Log Scale                              |   | -1.661 |
| 123 |                                                                                                                           |   |   |   | SD in Original Scale                                | 0.212  |                                                                 |   |   | SD in Log Scale                                |   | 1.112  |
| 124 |                                                                                                                           |   |   |   | 95% t UCL (assumes normality of ROS data)           | 0.428  |                                                                 |   |   | 95% Percentile Bootstrap UCL                   |   | 0.401  |
| 125 |                                                                                                                           |   |   |   | 95% BCA Bootstrap UCL                               | 0.403  |                                                                 |   |   | 95% Bootstrap t UCL                            |   | 0.429  |
| 126 |                                                                                                                           |   |   |   | 95% H-UCL (Log ROS)                                 | 1.674  |                                                                 |   |   |                                                |   |        |
| 127 |                                                                                                                           |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 128 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |
| 129 |                                                                                                                           |   |   |   | KM Mean (logged)                                    | -1.578 |                                                                 |   |   | KM Geo Mean                                    |   | 0.206  |
| 130 |                                                                                                                           |   |   |   | KM SD (logged)                                      | 0.91   |                                                                 |   |   | 95% Critical H Value (KM-Log)                  |   | 3.208  |
| 131 |                                                                                                                           |   |   |   | KM Standard Error of Mean (logged)                  | 0.348  |                                                                 |   |   | 95% H-UCL (KM -Log)                            |   | 0.942  |
| 132 |                                                                                                                           |   |   |   | KM SD (logged)                                      | 0.91   |                                                                 |   |   | 95% Critical H Value (KM-Log)                  |   | 3.208  |
| 133 |                                                                                                                           |   |   |   | KM Standard Error of Mean (logged)                  | 0.348  |                                                                 |   |   |                                                |   |        |
| 134 |                                                                                                                           |   |   |   |                                                     |        |                                                                 |   |   |                                                |   |        |

| A   | B                                                                                                                                        | C | D | E      | F | G                                                               | H | I | J       | K | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|---|-----------------------------------------------------------------|---|---|---------|---|---|
| 135 | <b>DL/2 Statistics</b>                                                                                                                   |   |   |        |   |                                                                 |   |   |         |   |   |
| 136 | <b>DL/2 Normal</b>                                                                                                                       |   |   |        |   | <b>DL/2 Log-Transformed</b>                                     |   |   |         |   |   |
| 137 | Mean in Original Scale                                                                                                                   |   |   | 0.286  |   | Mean in Log Scale                                               |   |   | -1.664  |   |   |
| 138 | SD in Original Scale                                                                                                                     |   |   | 0.212  |   | SD in Log Scale                                                 |   |   | 1.118   |   |   |
| 139 | 95% t UCL (Assumes normality)                                                                                                            |   |   | 0.428  |   | 95% H-Stat UCL                                                  |   |   | 1.703   |   |   |
| 140 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |   |        |   |                                                                 |   |   |         |   |   |
| 141 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |         |   |   |
| 142 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |   |                                                                 |   |   |         |   |   |
| 143 | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                  |   |   |        |   |                                                                 |   |   |         |   |   |
| 144 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |         |   |   |
| 145 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |   |                                                                 |   |   |         |   |   |
| 146 | 95% KM (t) UCL                                                                                                                           |   |   | 0.43   |   |                                                                 |   |   |         |   |   |
| 147 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |         |   |   |
| 148 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |   |                                                                 |   |   |         |   |   |
| 149 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |   |                                                                 |   |   |         |   |   |
| 150 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |   |                                                                 |   |   |         |   |   |
| 151 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |   |                                                                 |   |   |         |   |   |
| 152 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |         |   |   |
| 153 | <b>Result (eu8_beryllium)</b>                                                                                                            |   |   |        |   |                                                                 |   |   |         |   |   |
| 154 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |         |   |   |
| 155 | <b>General Statistics</b>                                                                                                                |   |   |        |   |                                                                 |   |   |         |   |   |
| 156 | Total Number of Observations                                                                                                             |   |   | 8      |   | Number of Distinct Observations                                 |   |   | 8       |   |   |
| 157 | Number of Detects                                                                                                                        |   |   | 0      |   | Number of Non-Detects                                           |   |   | 8       |   |   |
| 158 | Number of Distinct Detects                                                                                                               |   |   | 0      |   | Number of Distinct Non-Detects                                  |   |   | 8       |   |   |
| 159 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |         |   |   |
| 160 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                       |   |   |        |   |                                                                 |   |   |         |   |   |
| 161 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>                 |   |   |        |   |                                                                 |   |   |         |   |   |
| 162 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>        |   |   |        |   |                                                                 |   |   |         |   |   |
| 163 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |         |   |   |
| 164 | <b>The data set for variable Result (eu8_beryllium) was not processed!</b>                                                               |   |   |        |   |                                                                 |   |   |         |   |   |
| 165 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |         |   |   |
| 166 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |         |   |   |
| 167 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |         |   |   |
| 168 | <b>Result (eu8_cadmium)</b>                                                                                                              |   |   |        |   |                                                                 |   |   |         |   |   |
| 169 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |         |   |   |
| 170 | <b>General Statistics</b>                                                                                                                |   |   |        |   |                                                                 |   |   |         |   |   |
| 171 | Total Number of Observations                                                                                                             |   |   | 8      |   | Number of Distinct Observations                                 |   |   | 8       |   |   |
| 172 |                                                                                                                                          |   |   |        |   | Number of Missing Observations                                  |   |   | 0       |   |   |
| 173 | Minimum                                                                                                                                  |   |   | 0.0141 |   | Mean                                                            |   |   | 0.0332  |   |   |
| 174 | Maximum                                                                                                                                  |   |   | 0.0637 |   | Median                                                          |   |   | 0.0285  |   |   |
| 175 | SD                                                                                                                                       |   |   | 0.0173 |   | Std. Error of Mean                                              |   |   | 0.00612 |   |   |
| 176 | Coefficient of Variation                                                                                                                 |   |   | 0.522  |   | Skewness                                                        |   |   | 0.746   |   |   |
| 177 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |         |   |   |
| 178 | Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use                                         |   |   |        |   |                                                                 |   |   |         |   |   |
| 179 | guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.                                          |   |   |        |   |                                                                 |   |   |         |   |   |
| 180 | For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).                                                             |   |   |        |   |                                                                 |   |   |         |   |   |
| 181 | Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1                                                  |   |   |        |   |                                                                 |   |   |         |   |   |
| 182 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |         |   |   |
| 183 | <b>Normal GOF Test</b>                                                                                                                   |   |   |        |   |                                                                 |   |   |         |   |   |
| 184 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.921  |   | <b>Shapiro Wilk GOF Test</b>                                    |   |   |         |   |   |
| 185 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.818  |   | Data appear Normal at 5% Significance Level                     |   |   |         |   |   |
| 186 | Lilliefors Test Statistic                                                                                                                |   |   | 0.224  |   | <b>Lilliefors GOF Test</b>                                      |   |   |         |   |   |
| 187 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.283  |   | Data appear Normal at 5% Significance Level                     |   |   |         |   |   |
| 188 | <b>Data appear Normal at 5% Significance Level</b>                                                                                       |   |   |        |   |                                                                 |   |   |         |   |   |
| 189 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |         |   |   |
| 190 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |        |   |                                                                 |   |   |         |   |   |
| 191 | <b>95% Normal UCL</b>                                                                                                                    |   |   |        |   | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |         |   |   |
| 192 | 95% Student's-t UCL                                                                                                                      |   |   | 0.0448 |   | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   | 0.045   |   |   |
| 193 |                                                                                                                                          |   |   |        |   | 95% Modified-t UCL (Johnson-1978)                               |   |   | 0.0451  |   |   |
| 194 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |         |   |   |
| 195 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |        |   |                                                                 |   |   |         |   |   |
| 196 | A-D Test Statistic                                                                                                                       |   |   | 0.253  |   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |         |   |   |
| 197 | 5% A-D Critical Value                                                                                                                    |   |   | 0.719  |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |         |   |   |
| 198 | K-S Test Statistic                                                                                                                       |   |   | 0.173  |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |         |   |   |
| 199 | 5% K-S Critical Value                                                                                                                    |   |   | 0.295  |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |         |   |   |
| 200 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |        |   |                                                                 |   |   |         |   |   |
| 201 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |         |   |   |

| A   | B                                                                                                                                        | C | D       | E | G                                              | H | I      | J | K | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---------|---|------------------------------------------------|---|--------|---|---|---|
| 202 | <b>Gamma Statistics</b>                                                                                                                  |   |         |   |                                                |   |        |   |   |   |
| 203 | k hat (MLE)                                                                                                                              |   | 4.317   |   | k star (bias corrected MLE)                    |   | 2.781  |   |   |   |
| 204 | Theta hat (MLE)                                                                                                                          |   | 0.00769 |   | Theta star (bias corrected MLE)                |   | 0.0119 |   |   |   |
| 205 | nu hat (MLE)                                                                                                                             |   | 69.07   |   | nu star (bias corrected)                       |   | 44.5   |   |   |   |
| 206 | MLE Mean (bias corrected)                                                                                                                |   | 0.0332  |   | MLE Sd (bias corrected)                        |   | 0.0199 |   |   |   |
| 207 |                                                                                                                                          |   |         |   | Approximate Chi Square Value (0.05)            |   | 30.2   |   |   |   |
| 208 | Adjusted Level of Significance                                                                                                           |   | 0.0195  |   | Adjusted Chi Square Value                      |   | 27.25  |   |   |   |
| 209 |                                                                                                                                          |   |         |   |                                                |   |        |   |   |   |
| 210 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |         |   |                                                |   |        |   |   |   |
| 211 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   | 0.0489  |   | 95% Adjusted Gamma UCL (use when n<50)         |   | 0.0542 |   |   |   |
| 212 |                                                                                                                                          |   |         |   |                                                |   |        |   |   |   |
| 213 | <b>Lognormal GOF Test</b>                                                                                                                |   |         |   |                                                |   |        |   |   |   |
| 214 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.961   |   | <b>Shapiro Wilk Lognormal GOF Test</b>         |   |        |   |   |   |
| 215 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.818   |   | Data appear Lognormal at 5% Significance Level |   |        |   |   |   |
| 216 | Lilliefors Test Statistic                                                                                                                |   | 0.15    |   | <b>Lilliefors Lognormal GOF Test</b>           |   |        |   |   |   |
| 217 | 5% Lilliefors Critical Value                                                                                                             |   | 0.283   |   | Data appear Lognormal at 5% Significance Level |   |        |   |   |   |
| 218 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |         |   |                                                |   |        |   |   |   |
| 219 |                                                                                                                                          |   |         |   |                                                |   |        |   |   |   |
| 220 | <b>Lognormal Statistics</b>                                                                                                              |   |         |   |                                                |   |        |   |   |   |
| 221 | Minimum of Logged Data                                                                                                                   |   | -4.259  |   | Mean of logged Data                            |   | -3.526 |   |   |   |
| 222 | Maximum of Logged Data                                                                                                                   |   | -2.754  |   | SD of logged Data                              |   | 0.528  |   |   |   |
| 223 |                                                                                                                                          |   |         |   |                                                |   |        |   |   |   |
| 224 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |         |   |                                                |   |        |   |   |   |
| 225 | 95% H-UCL                                                                                                                                |   | 0.0546  |   | 90% Chebyshev (MVUE) UCL                       |   | 0.052  |   |   |   |
| 226 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 0.0605  |   | 97.5% Chebyshev (MVUE) UCL                     |   | 0.0723 |   |   |   |
| 227 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 0.0955  |   |                                                |   |        |   |   |   |
| 228 |                                                                                                                                          |   |         |   |                                                |   |        |   |   |   |
| 229 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |         |   |                                                |   |        |   |   |   |
| 230 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |         |   |                                                |   |        |   |   |   |
| 231 |                                                                                                                                          |   |         |   |                                                |   |        |   |   |   |
| 232 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |         |   |                                                |   |        |   |   |   |
| 233 | 95% CLT UCL                                                                                                                              |   | 0.0433  |   | 95% Jackknife UCL                              |   | 0.0448 |   |   |   |
| 234 | 95% Standard Bootstrap UCL                                                                                                               |   | 0.0426  |   | 95% Bootstrap-t UCL                            |   | 0.0481 |   |   |   |
| 235 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 0.0439  |   | 95% Percentile Bootstrap UCL                   |   | 0.0426 |   |   |   |
| 236 | 95% BCA Bootstrap UCL                                                                                                                    |   | 0.0438  |   |                                                |   |        |   |   |   |
| 237 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 0.0516  |   | 95% Chebyshev(Mean, Sd) UCL                    |   | 0.0599 |   |   |   |
| 238 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 0.0714  |   | 99% Chebyshev(Mean, Sd) UCL                    |   | 0.0941 |   |   |   |
| 239 |                                                                                                                                          |   |         |   |                                                |   |        |   |   |   |
| 240 | <b>Suggested UCL to Use</b>                                                                                                              |   |         |   |                                                |   |        |   |   |   |
| 241 | 95% Student's-t UCL                                                                                                                      |   | 0.0448  |   |                                                |   |        |   |   |   |
| 242 |                                                                                                                                          |   |         |   |                                                |   |        |   |   |   |
| 243 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |         |   |                                                |   |        |   |   |   |
| 244 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |         |   |                                                |   |        |   |   |   |
| 245 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |         |   |                                                |   |        |   |   |   |
| 246 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |         |   |                                                |   |        |   |   |   |
| 247 |                                                                                                                                          |   |         |   |                                                |   |        |   |   |   |
| 248 |                                                                                                                                          |   |         |   |                                                |   |        |   |   |   |
| 249 | <b>Result (eu8_chromium)</b>                                                                                                             |   |         |   |                                                |   |        |   |   |   |
| 250 |                                                                                                                                          |   |         |   |                                                |   |        |   |   |   |
| 251 | <b>General Statistics</b>                                                                                                                |   |         |   |                                                |   |        |   |   |   |
| 252 | Total Number of Observations                                                                                                             |   | 8       |   | Number of Distinct Observations                |   | 8      |   |   |   |
| 253 |                                                                                                                                          |   |         |   | Number of Missing Observations                 |   | 0      |   |   |   |
| 254 | Minimum                                                                                                                                  |   | 0.687   |   | Mean                                           |   | 0.819  |   |   |   |
| 255 | Maximum                                                                                                                                  |   | 0.894   |   | Median                                         |   | 0.825  |   |   |   |
| 256 | SD                                                                                                                                       |   | 0.0618  |   | Std. Error of Mean                             |   | 0.0219 |   |   |   |
| 257 | Coefficient of Variation                                                                                                                 |   | 0.0755  |   | Skewness                                       |   | -1.443 |   |   |   |
| 258 |                                                                                                                                          |   |         |   |                                                |   |        |   |   |   |
| 259 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |   |         |   |                                                |   |        |   |   |   |
| 260 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |   |         |   |                                                |   |        |   |   |   |
| 261 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |   |         |   |                                                |   |        |   |   |   |
| 262 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |   |         |   |                                                |   |        |   |   |   |
| 263 |                                                                                                                                          |   |         |   |                                                |   |        |   |   |   |
| 264 | <b>Normal GOF Test</b>                                                                                                                   |   |         |   |                                                |   |        |   |   |   |
| 265 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.878   |   | <b>Shapiro Wilk GOF Test</b>                   |   |        |   |   |   |
| 266 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.818   |   | Data appear Normal at 5% Significance Level    |   |        |   |   |   |
| 267 | Lilliefors Test Statistic                                                                                                                |   | 0.263   |   | <b>Lilliefors GOF Test</b>                     |   |        |   |   |   |
| 268 | 5% Lilliefors Critical Value                                                                                                             |   | 0.283   |   | Data appear Normal at 5% Significance Level    |   |        |   |   |   |

| A   | B                                                                                                                                                                                                                    | C | D       | E                               | F                                                               | G | H | I | J       | K      | L |  |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|---------------------------------|-----------------------------------------------------------------|---|---|---|---------|--------|---|--|
| 269 | <b>Data appear Normal at 5% Significance Level</b>                                                                                                                                                                   |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 270 |                                                                                                                                                                                                                      |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 271 | <b>Assuming Normal Distribution</b>                                                                                                                                                                                  |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 272 | <b>95% Normal UCL</b>                                                                                                                                                                                                |   |         |                                 | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |   |         |        |   |  |
| 273 | 95% Student's-t UCL                                                                                                                                                                                                  |   |         | 0.861                           | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |   |         | 0.843  |   |  |
| 274 |                                                                                                                                                                                                                      |   |         |                                 | 95% Modified-t UCL (Johnson-1978)                               |   |   |   |         | 0.859  |   |  |
| 275 |                                                                                                                                                                                                                      |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 276 | <b>Gamma GOF Test</b>                                                                                                                                                                                                |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 277 | A-D Test Statistic                                                                                                                                                                                                   |   |         | 0.537                           | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |   |         |        |   |  |
| 278 | 5% A-D Critical Value                                                                                                                                                                                                |   |         | 0.715                           | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |         |        |   |  |
| 279 | K-S Test Statistic                                                                                                                                                                                                   |   |         | 0.267                           | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |   |         |        |   |  |
| 280 | 5% K-S Critical Value                                                                                                                                                                                                |   |         | 0.294                           | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |         |        |   |  |
| 281 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                                                                                               |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 282 |                                                                                                                                                                                                                      |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 283 | <b>Gamma Statistics</b>                                                                                                                                                                                              |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 284 | k hat (MLE)                                                                                                                                                                                                          |   | 188.5   | k star (bias corrected MLE)     |                                                                 |   |   |   | 117.9   |        |   |  |
| 285 | Theta hat (MLE)                                                                                                                                                                                                      |   | 0.00435 | Theta star (bias corrected MLE) |                                                                 |   |   |   | 0.00695 |        |   |  |
| 286 | nu hat (MLE)                                                                                                                                                                                                         |   | 3016    | nu star (bias corrected)        |                                                                 |   |   |   | 1887    |        |   |  |
| 287 | MLE Mean (bias corrected)                                                                                                                                                                                            |   |         | 0.819                           | MLE Sd (bias corrected)                                         |   |   |   |         | 0.0754 |   |  |
| 288 |                                                                                                                                                                                                                      |   |         |                                 | Approximate Chi Square Value (0.05)                             |   |   |   |         | 1787   |   |  |
| 289 | Adjusted Level of Significance                                                                                                                                                                                       |   |         | 0.0195                          | Adjusted Chi Square Value                                       |   |   |   |         | 1762   |   |  |
| 290 |                                                                                                                                                                                                                      |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 291 | <b>Assuming Gamma Distribution</b>                                                                                                                                                                                   |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 292 | 95% Approximate Gamma UCL (use when n>=50))                                                                                                                                                                          |   |         | 0.865                           | 95% Adjusted Gamma UCL (use when n<50)                          |   |   |   |         | 0.877  |   |  |
| 293 |                                                                                                                                                                                                                      |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 294 | <b>Lognormal GOF Test</b>                                                                                                                                                                                            |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 295 | Shapiro Wilk Test Statistic                                                                                                                                                                                          |   |         | 0.851                           | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |   |         |        |   |  |
| 296 | 5% Shapiro Wilk Critical Value                                                                                                                                                                                       |   |         | 0.818                           | Data appear Lognormal at 5% Significance Level                  |   |   |   |         |        |   |  |
| 297 | Lilliefors Test Statistic                                                                                                                                                                                            |   |         | 0.28                            | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |   |         |        |   |  |
| 298 | 5% Lilliefors Critical Value                                                                                                                                                                                         |   |         | 0.283                           | Data appear Lognormal at 5% Significance Level                  |   |   |   |         |        |   |  |
| 299 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                                                                                                |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 300 |                                                                                                                                                                                                                      |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 301 | <b>Lognormal Statistics</b>                                                                                                                                                                                          |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 302 | Minimum of Logged Data                                                                                                                                                                                               |   |         | -0.376                          | Mean of logged Data                                             |   |   |   |         | -0.202 |   |  |
| 303 | Maximum of Logged Data                                                                                                                                                                                               |   |         | -0.112                          | SD of logged Data                                               |   |   |   |         | 0.0792 |   |  |
| 304 |                                                                                                                                                                                                                      |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 305 | <b>Assuming Lognormal Distribution</b>                                                                                                                                                                               |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 306 | 95% H-UCL                                                                                                                                                                                                            |   | N/A     | 90% Chebyshev (MVUE) UCL        |                                                                 |   |   |   | 0.888   |        |   |  |
| 307 | 95% Chebyshev (MVUE) UCL                                                                                                                                                                                             |   | 0.919   | 97.5% Chebyshev (MVUE) UCL      |                                                                 |   |   |   | 0.962   |        |   |  |
| 308 | 99% Chebyshev (MVUE) UCL                                                                                                                                                                                             |   | 1.047   |                                 |                                                                 |   |   |   |         |        |   |  |
| 309 |                                                                                                                                                                                                                      |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 310 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                                                                                                |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 311 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                                                                                                     |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 312 |                                                                                                                                                                                                                      |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 313 | <b>Nonparametric Distribution Free UCLs</b>                                                                                                                                                                          |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 314 | 95% CLT UCL                                                                                                                                                                                                          |   | 0.855   | 95% Jackknife UCL               |                                                                 |   |   |   | 0.861   |        |   |  |
| 315 | 95% Standard Bootstrap UCL                                                                                                                                                                                           |   | 0.852   | 95% Bootstrap-t UCL             |                                                                 |   |   |   | 0.85    |        |   |  |
| 316 | 95% Hall's Bootstrap UCL                                                                                                                                                                                             |   | 0.848   | 95% Percentile Bootstrap UCL    |                                                                 |   |   |   | 0.849   |        |   |  |
| 317 | 95% BCA Bootstrap UCL                                                                                                                                                                                                |   | 0.845   |                                 |                                                                 |   |   |   |         |        |   |  |
| 318 | 90% Chebyshev(Mean, Sd) UCL                                                                                                                                                                                          |   | 0.885   | 95% Chebyshev(Mean, Sd) UCL     |                                                                 |   |   |   | 0.914   |        |   |  |
| 319 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                                                                                                        |   | 0.956   | 99% Chebyshev(Mean, Sd) UCL     |                                                                 |   |   |   | 1.037   |        |   |  |
| 320 |                                                                                                                                                                                                                      |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 321 | <b>Suggested UCL to Use</b>                                                                                                                                                                                          |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 322 | 95% Student's-t UCL                                                                                                                                                                                                  |   | 0.861   |                                 |                                                                 |   |   |   |         |        |   |  |
| 323 |                                                                                                                                                                                                                      |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 324 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.                                                                                         |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 325 | Recommendations are based upon data size, data distribution, and skewness.                                                                                                                                           |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 326 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                                                                                             |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 327 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician                                                                             |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 328 |                                                                                                                                                                                                                      |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 329 | <b>Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.</b> |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 330 |                                                                                                                                                                                                                      |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 331 |                                                                                                                                                                                                                      |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 332 |                                                                                                                                                                                                                      |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 333 | <b>Result (eu8_copper)</b>                                                                                                                                                                                           |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 334 |                                                                                                                                                                                                                      |   |         |                                 |                                                                 |   |   |   |         |        |   |  |
| 335 | <b>General Statistics</b>                                                                                                                                                                                            |   |         |                                 |                                                                 |   |   |   |         |        |   |  |

|     | A                                                                                                          | B | C | D | E      | F                                                               | G | H | I | J      | K | L |
|-----|------------------------------------------------------------------------------------------------------------|---|---|---|--------|-----------------------------------------------------------------|---|---|---|--------|---|---|
| 336 | Total Number of Observations                                                                               |   |   |   | 8      | Number of Distinct Observations                                 |   |   |   | 8      |   |   |
| 337 |                                                                                                            |   |   |   |        | Number of Missing Observations                                  |   |   |   | 0      |   |   |
| 338 | Minimum                                                                                                    |   |   |   | 0.361  | Mean                                                            |   |   |   | 0.481  |   |   |
| 339 | Maximum                                                                                                    |   |   |   | 0.642  | Median                                                          |   |   |   | 0.463  |   |   |
| 340 | SD                                                                                                         |   |   |   | 0.0832 | Std. Error of Mean                                              |   |   |   | 0.0294 |   |   |
| 341 | Coefficient of Variation                                                                                   |   |   |   | 0.173  | Skewness                                                        |   |   |   | 0.852  |   |   |
| 342 |                                                                                                            |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 343 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b> |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 344 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>     |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 345 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                        |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 346 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>             |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 347 |                                                                                                            |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 348 | <b>Normal GOF Test</b>                                                                                     |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 349 | Shapiro Wilk Test Statistic                                                                                |   |   |   | 0.926  | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |        |   |   |
| 350 | 5% Shapiro Wilk Critical Value                                                                             |   |   |   | 0.818  | Data appear Normal at 5% Significance Level                     |   |   |   |        |   |   |
| 351 | Lilliefors Test Statistic                                                                                  |   |   |   | 0.227  | <b>Lilliefors GOF Test</b>                                      |   |   |   |        |   |   |
| 352 | 5% Lilliefors Critical Value                                                                               |   |   |   | 0.283  | Data appear Normal at 5% Significance Level                     |   |   |   |        |   |   |
| 353 | <b>Data appear Normal at 5% Significance Level</b>                                                         |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 354 |                                                                                                            |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 355 | <b>Assuming Normal Distribution</b>                                                                        |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 356 | <b>95% Normal UCL</b>                                                                                      |   |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |   |        |   |   |
| 357 | 95% Student's-t UCL                                                                                        |   |   |   | 0.537  | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |   | 0.539  |   |   |
| 358 |                                                                                                            |   |   |   |        | 95% Modified-t UCL (Johnson-1978)                               |   |   |   | 0.538  |   |   |
| 359 |                                                                                                            |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 360 | <b>Gamma GOF Test</b>                                                                                      |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 361 | A-D Test Statistic                                                                                         |   |   |   | 0.359  | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |   |        |   |   |
| 362 | 5% A-D Critical Value                                                                                      |   |   |   | 0.715  | detected data appear Gamma Distributed at 5% Significance Level |   |   |   |        |   |   |
| 363 | K-S Test Statistic                                                                                         |   |   |   | 0.205  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |   |        |   |   |
| 364 | 5% K-S Critical Value                                                                                      |   |   |   | 0.294  | detected data appear Gamma Distributed at 5% Significance Level |   |   |   |        |   |   |
| 365 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                     |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 366 |                                                                                                            |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 367 | <b>Gamma Statistics</b>                                                                                    |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 368 | k hat (MLE)                                                                                                |   |   |   | 39.85  | k star (bias corrected MLE)                                     |   |   |   | 24.99  |   |   |
| 369 | Theta hat (MLE)                                                                                            |   |   |   | 0.0121 | Theta star (bias corrected MLE)                                 |   |   |   | 0.0193 |   |   |
| 370 | nu hat (MLE)                                                                                               |   |   |   | 637.6  | nu star (bias corrected)                                        |   |   |   | 399.9  |   |   |
| 371 | MLE Mean (bias corrected)                                                                                  |   |   |   | 0.481  | MLE Sd (bias corrected)                                         |   |   |   | 0.0963 |   |   |
| 372 |                                                                                                            |   |   |   |        | Approximate Chi Square Value (0.05)                             |   |   |   | 354.5  |   |   |
| 373 | Adjusted Level of Significance                                                                             |   |   |   | 0.0195 | Adjusted Chi Square Value                                       |   |   |   | 343.7  |   |   |
| 374 |                                                                                                            |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 375 | <b>Assuming Gamma Distribution</b>                                                                         |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 376 | 95% Approximate Gamma UCL (use when n>=50)                                                                 |   |   |   | 0.543  | 95% Adjusted Gamma UCL (use when n<50)                          |   |   |   | 0.56   |   |   |
| 377 |                                                                                                            |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 378 | <b>Lognormal GOF Test</b>                                                                                  |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 379 | Shapiro Wilk Test Statistic                                                                                |   |   |   | 0.949  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |   |        |   |   |
| 380 | 5% Shapiro Wilk Critical Value                                                                             |   |   |   | 0.818  | Data appear Lognormal at 5% Significance Level                  |   |   |   |        |   |   |
| 381 | Lilliefors Test Statistic                                                                                  |   |   |   | 0.197  | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |   |        |   |   |
| 382 | 5% Lilliefors Critical Value                                                                               |   |   |   | 0.283  | Data appear Lognormal at 5% Significance Level                  |   |   |   |        |   |   |
| 383 | <b>Data appear Lognormal at 5% Significance Level</b>                                                      |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 384 |                                                                                                            |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 385 | <b>Lognormal Statistics</b>                                                                                |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 386 | Minimum of Logged Data                                                                                     |   |   |   | -1.018 | Mean of logged Data                                             |   |   |   | -0.744 |   |   |
| 387 | Maximum of Logged Data                                                                                     |   |   |   | -0.444 | SD of logged Data                                               |   |   |   | 0.169  |   |   |
| 388 |                                                                                                            |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 389 | <b>Assuming Lognormal Distribution</b>                                                                     |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 390 | 95% H-UCL                                                                                                  |   |   |   | 0.544  | 90% Chebyshev (MVUE) UCL                                        |   |   |   | 0.567  |   |   |
| 391 | 95% Chebyshev (MVUE) UCL                                                                                   |   |   |   | 0.606  | 97.5% Chebyshev (MVUE) UCL                                      |   |   |   | 0.66   |   |   |
| 392 | 99% Chebyshev (MVUE) UCL                                                                                   |   |   |   | 0.767  |                                                                 |   |   |   |        |   |   |
| 393 |                                                                                                            |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 394 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                      |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 395 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                           |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 396 |                                                                                                            |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 397 | <b>Nonparametric Distribution Free UCLs</b>                                                                |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 398 | 95% CLT UCL                                                                                                |   |   |   | 0.53   | 95% Jackknife UCL                                               |   |   |   | 0.537  |   |   |
| 399 | 95% Standard Bootstrap UCL                                                                                 |   |   |   | 0.526  | 95% Bootstrap-t UCL                                             |   |   |   | 0.559  |   |   |
| 400 | 95% Hall's Bootstrap UCL                                                                                   |   |   |   | 0.937  | 95% Percentile Bootstrap UCL                                    |   |   |   | 0.527  |   |   |
| 401 | 95% BCA Bootstrap UCL                                                                                      |   |   |   | 0.537  |                                                                 |   |   |   |        |   |   |
| 402 | 90% Chebyshev(Mean, Sd) UCL                                                                                |   |   |   | 0.569  | 95% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 0.609  |   |   |

| A   | B                                                                                                                                        | C | D | E      | F                                                               | G | H | I       | J | K | L |  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------------------|---|---|---------|---|---|---|--|
| 403 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 0.665  | 99% Chebyshev(Mean, Sd) UCL                                     |   |   | 0.774   |   |   |   |  |
| 404 |                                                                                                                                          |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 405 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 406 | 95% Student's-t UCL                                                                                                                      |   |   | 0.537  |                                                                 |   |   |         |   |   |   |  |
| 407 |                                                                                                                                          |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 408 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 409 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 410 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 411 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 412 |                                                                                                                                          |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 413 | <b>Result (eu8_iron)</b>                                                                                                                 |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 414 |                                                                                                                                          |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 415 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 416 | Total Number of Observations                                                                                                             |   |   | 8      | Number of Distinct Observations                                 |   |   | 8       |   |   |   |  |
| 417 | Number of Detects                                                                                                                        |   |   | 0      | Number of Non-Detects                                           |   |   | 8       |   |   |   |  |
| 418 | Number of Distinct Detects                                                                                                               |   |   | 0      | Number of Distinct Non-Detects                                  |   |   | 8       |   |   |   |  |
| 419 |                                                                                                                                          |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 420 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                       |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 421 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>                 |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 422 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>        |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 423 |                                                                                                                                          |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 424 | <b>The data set for variable Result (eu8_iron) was not processed!</b>                                                                    |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 425 |                                                                                                                                          |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 426 |                                                                                                                                          |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 427 |                                                                                                                                          |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 428 | <b>Result (eu8_lead)</b>                                                                                                                 |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 429 |                                                                                                                                          |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 430 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 431 | Total Number of Observations                                                                                                             |   |   | 8      | Number of Distinct Observations                                 |   |   | 8       |   |   |   |  |
| 432 |                                                                                                                                          |   |   |        | Number of Missing Observations                                  |   |   | 0       |   |   |   |  |
| 433 | Minimum                                                                                                                                  |   |   | 0.0108 | Mean                                                            |   |   | 0.0368  |   |   |   |  |
| 434 | Maximum                                                                                                                                  |   |   | 0.0685 | Median                                                          |   |   | 0.0413  |   |   |   |  |
| 435 | SD                                                                                                                                       |   |   | 0.0224 | Std. Error of Mean                                              |   |   | 0.00793 |   |   |   |  |
| 436 | Coefficient of Variation                                                                                                                 |   |   | 0.61   | Skewness                                                        |   |   | -0.0436 |   |   |   |  |
| 437 |                                                                                                                                          |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 438 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 439 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 440 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 441 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 442 |                                                                                                                                          |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 443 | <b>Normal GOF Test</b>                                                                                                                   |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 444 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.891  | <b>Shapiro Wilk GOF Test</b>                                    |   |   |         |   |   |   |  |
| 445 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.818  | Data appear Normal at 5% Significance Level                     |   |   |         |   |   |   |  |
| 446 | Lilliefors Test Statistic                                                                                                                |   |   | 0.217  | <b>Lilliefors GOF Test</b>                                      |   |   |         |   |   |   |  |
| 447 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.283  | Data appear Normal at 5% Significance Level                     |   |   |         |   |   |   |  |
| 448 | <b>Data appear Normal at 5% Significance Level</b>                                                                                       |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 449 |                                                                                                                                          |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 450 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 451 | <b>95% Normal UCL</b>                                                                                                                    |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |         |   |   |   |  |
| 452 | 95% Student's-t UCL                                                                                                                      |   |   | 0.0518 | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   | 0.0497  |   |   |   |  |
| 453 |                                                                                                                                          |   |   |        | 95% Modified-t UCL (Johnson-1978)                               |   |   | 0.0518  |   |   |   |  |
| 454 |                                                                                                                                          |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 455 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 456 | A-D Test Statistic                                                                                                                       |   |   | 0.603  | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |         |   |   |   |  |
| 457 | 5% A-D Critical Value                                                                                                                    |   |   | 0.723  | detected data appear Gamma Distributed at 5% Significance Level |   |   |         |   |   |   |  |
| 458 | K-S Test Statistic                                                                                                                       |   |   | 0.243  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |         |   |   |   |  |
| 459 | 5% K-S Critical Value                                                                                                                    |   |   | 0.297  | detected data appear Gamma Distributed at 5% Significance Level |   |   |         |   |   |   |  |
| 460 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 461 |                                                                                                                                          |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 462 | <b>Gamma Statistics</b>                                                                                                                  |   |   |        |                                                                 |   |   |         |   |   |   |  |
| 463 | k hat (MLE)                                                                                                                              |   |   | 2.406  | k star (bias corrected MLE)                                     |   |   | 1.587   |   |   |   |  |
| 464 | Theta hat (MLE)                                                                                                                          |   |   | 0.0153 | Theta star (bias corrected MLE)                                 |   |   | 0.0232  |   |   |   |  |
| 465 | nu hat (MLE)                                                                                                                             |   |   | 38.5   | nu star (bias corrected)                                        |   |   | 25.4    |   |   |   |  |
| 466 | MLE Mean (bias corrected)                                                                                                                |   |   | 0.0368 | MLE Sd (bias corrected)                                         |   |   | 0.0292  |   |   |   |  |
| 467 |                                                                                                                                          |   |   |        | Approximate Chi Square Value (0.05)                             |   |   | 14.92   |   |   |   |  |
| 468 | Adjusted Level of Significance                                                                                                           |   |   | 0.0195 | Adjusted Chi Square Value                                       |   |   | 12.93   |   |   |   |  |
| 469 |                                                                                                                                          |   |   |        |                                                                 |   |   |         |   |   |   |  |

| A   | B                                                                                                                                        | C | D | E      | F                                              | G | H | I      | J | K | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|------------------------------------------------|---|---|--------|---|---|---|
| 470 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |        |                                                |   |   |        |   |   |   |
| 471 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |   | 0.0626 | 95% Adjusted Gamma UCL (use when n<50)         |   |   | 0.0722 |   |   |   |
| 472 |                                                                                                                                          |   |   |        |                                                |   |   |        |   |   |   |
| 473 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |        |                                                |   |   |        |   |   |   |
| 474 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.839  | <b>Shapiro Wilk Lognormal GOF Test</b>         |   |   |        |   |   |   |
| 475 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.818  | Data appear Lognormal at 5% Significance Level |   |   |        |   |   |   |
| 476 | Lilliefors Test Statistic                                                                                                                |   |   | 0.24   | <b>Lilliefors Lognormal GOF Test</b>           |   |   |        |   |   |   |
| 477 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.283  | Data appear Lognormal at 5% Significance Level |   |   |        |   |   |   |
| 478 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |        |                                                |   |   |        |   |   |   |
| 479 |                                                                                                                                          |   |   |        |                                                |   |   |        |   |   |   |
| 480 | <b>Lognormal Statistics</b>                                                                                                              |   |   |        |                                                |   |   |        |   |   |   |
| 481 | Minimum of Logged Data                                                                                                                   |   |   | -4.528 | Mean of logged Data                            |   |   | -3.525 |   |   |   |
| 482 | Maximum of Logged Data                                                                                                                   |   |   | -2.682 | SD of logged Data                              |   |   | 0.767  |   |   |   |
| 483 |                                                                                                                                          |   |   |        |                                                |   |   |        |   |   |   |
| 484 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |        |                                                |   |   |        |   |   |   |
| 485 | 95% H-UCL                                                                                                                                |   |   | 0.091  | 90% Chebyshev (MVUE) UCL                       |   |   | 0.0692 |   |   |   |
| 486 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 0.0834 | 97.5% Chebyshev (MVUE) UCL                     |   |   | 0.103  |   |   |   |
| 487 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 0.142  |                                                |   |   |        |   |   |   |
| 488 |                                                                                                                                          |   |   |        |                                                |   |   |        |   |   |   |
| 489 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |                                                |   |   |        |   |   |   |
| 490 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |        |                                                |   |   |        |   |   |   |
| 491 |                                                                                                                                          |   |   |        |                                                |   |   |        |   |   |   |
| 492 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |        |                                                |   |   |        |   |   |   |
| 493 | 95% CLT UCL                                                                                                                              |   |   | 0.0498 | 95% Jackknife UCL                              |   |   | 0.0518 |   |   |   |
| 494 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 0.0484 | 95% Bootstrap-t UCL                            |   |   | 0.0503 |   |   |   |
| 495 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 0.0478 | 95% Percentile Bootstrap UCL                   |   |   | 0.0495 |   |   |   |
| 496 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 0.0491 |                                                |   |   |        |   |   |   |
| 497 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 0.0606 | 95% Chebyshev(Mean, Sd) UCL                    |   |   | 0.0713 |   |   |   |
| 498 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 0.0863 | 99% Chebyshev(Mean, Sd) UCL                    |   |   | 0.116  |   |   |   |
| 499 |                                                                                                                                          |   |   |        |                                                |   |   |        |   |   |   |
| 500 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                |   |   |        |   |   |   |
| 501 | 95% Student's-t UCL                                                                                                                      |   |   | 0.0518 |                                                |   |   |        |   |   |   |
| 502 |                                                                                                                                          |   |   |        |                                                |   |   |        |   |   |   |
| 503 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                |   |   |        |   |   |   |
| 504 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                |   |   |        |   |   |   |
| 505 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                |   |   |        |   |   |   |
| 506 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                |   |   |        |   |   |   |
| 507 |                                                                                                                                          |   |   |        |                                                |   |   |        |   |   |   |
| 508 | <b>Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be</b>                 |   |   |        |                                                |   |   |        |   |   |   |
| 509 | <b>reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.</b>                                       |   |   |        |                                                |   |   |        |   |   |   |
| 510 |                                                                                                                                          |   |   |        |                                                |   |   |        |   |   |   |
| 511 | <b>Result (eu8_manganese)</b>                                                                                                            |   |   |        |                                                |   |   |        |   |   |   |
| 512 |                                                                                                                                          |   |   |        |                                                |   |   |        |   |   |   |
| 513 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                |   |   |        |   |   |   |
| 514 | Total Number of Observations                                                                                                             |   |   | 8      | Number of Distinct Observations                |   |   | 8      |   |   |   |
| 515 | Number of Detects                                                                                                                        |   |   | 0      | Number of Non-Detects                          |   |   | 8      |   |   |   |
| 516 | Number of Distinct Detects                                                                                                               |   |   | 0      | Number of Distinct Non-Detects                 |   |   | 8      |   |   |   |
| 517 |                                                                                                                                          |   |   |        |                                                |   |   |        |   |   |   |
| 518 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                       |   |   |        |                                                |   |   |        |   |   |   |
| 519 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>                 |   |   |        |                                                |   |   |        |   |   |   |
| 520 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>        |   |   |        |                                                |   |   |        |   |   |   |
| 521 |                                                                                                                                          |   |   |        |                                                |   |   |        |   |   |   |
| 522 | <b>The data set for variable Result (eu8_manganese) was not processed!</b>                                                               |   |   |        |                                                |   |   |        |   |   |   |
| 523 |                                                                                                                                          |   |   |        |                                                |   |   |        |   |   |   |
| 524 |                                                                                                                                          |   |   |        |                                                |   |   |        |   |   |   |
| 525 |                                                                                                                                          |   |   |        |                                                |   |   |        |   |   |   |
| 526 | <b>Result (eu8_mercury)</b>                                                                                                              |   |   |        |                                                |   |   |        |   |   |   |
| 527 |                                                                                                                                          |   |   |        |                                                |   |   |        |   |   |   |
| 528 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                |   |   |        |   |   |   |
| 529 | Total Number of Observations                                                                                                             |   |   | 8      | Number of Distinct Observations                |   |   | 8      |   |   |   |
| 530 |                                                                                                                                          |   |   |        | Number of Missing Observations                 |   |   | 0      |   |   |   |
| 531 | Minimum                                                                                                                                  |   |   | 0.0239 | Mean                                           |   |   | 0.0381 |   |   |   |
| 532 | Maximum                                                                                                                                  |   |   | 0.0582 | Median                                         |   |   | 0.0369 |   |   |   |
| 533 | SD                                                                                                                                       |   |   | 0.011  | Std. Error of Mean                             |   |   | 0.0039 |   |   |   |
| 534 | Coefficient of Variation                                                                                                                 |   |   | 0.289  | Skewness                                       |   |   | 0.673  |   |   |   |
| 535 |                                                                                                                                          |   |   |        |                                                |   |   |        |   |   |   |
| 536 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |   |   |        |                                                |   |   |        |   |   |   |

| A   | B                                                                                                                            | C       | D                                                               | E | F                                       | G | H | I | J       | K | L |
|-----|------------------------------------------------------------------------------------------------------------------------------|---------|-----------------------------------------------------------------|---|-----------------------------------------|---|---|---|---------|---|---|
| 537 | guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.                              |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 538 | For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).                                                 |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 539 | Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1                                      |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 540 |                                                                                                                              |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 541 | <b>Normal GOF Test</b>                                                                                                       |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 542 | Shapiro Wilk Test Statistic                                                                                                  | 0.942   | <b>Shapiro Wilk GOF Test</b>                                    |   |                                         |   |   |   |         |   |   |
| 543 | 5% Shapiro Wilk Critical Value                                                                                               | 0.818   | Data appear Normal at 5% Significance Level                     |   |                                         |   |   |   |         |   |   |
| 544 | Lilliefors Test Statistic                                                                                                    | 0.216   | <b>Lilliefors GOF Test</b>                                      |   |                                         |   |   |   |         |   |   |
| 545 | 5% Lilliefors Critical Value                                                                                                 | 0.283   | Data appear Normal at 5% Significance Level                     |   |                                         |   |   |   |         |   |   |
| 546 | <b>Data appear Normal at 5% Significance Level</b>                                                                           |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 547 |                                                                                                                              |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 548 | <b>Assuming Normal Distribution</b>                                                                                          |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 549 | <b>95% Normal UCL</b>                                                                                                        |         |                                                                 |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |   |   |         |   |   |
| 550 | 95% Student's-t UCL                                                                                                          | 0.0455  | 95% Adjusted-CLT UCL (Chen-1995)                                |   |                                         |   |   |   | 0.0455  |   |   |
| 551 |                                                                                                                              |         | 95% Modified-t UCL (Johnson-1978)                               |   |                                         |   |   |   | 0.0457  |   |   |
| 552 |                                                                                                                              |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 553 | <b>Gamma GOF Test</b>                                                                                                        |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 554 | A-D Test Statistic                                                                                                           | 0.264   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |                                         |   |   |   |         |   |   |
| 555 | 5% A-D Critical Value                                                                                                        | 0.715   | Detected data appear Gamma Distributed at 5% Significance Level |   |                                         |   |   |   |         |   |   |
| 556 | K-S Test Statistic                                                                                                           | 0.178   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |                                         |   |   |   |         |   |   |
| 557 | 5% K-S Critical Value                                                                                                        | 0.294   | Detected data appear Gamma Distributed at 5% Significance Level |   |                                         |   |   |   |         |   |   |
| 558 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                       |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 559 |                                                                                                                              |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 560 | <b>Gamma Statistics</b>                                                                                                      |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 561 | k hat (MLE)                                                                                                                  | 14.03   | k star (bias corrected MLE)                                     |   |                                         |   |   |   | 8.851   |   |   |
| 562 | Theta hat (MLE)                                                                                                              | 0.00272 | Theta star (bias corrected MLE)                                 |   |                                         |   |   |   | 0.00431 |   |   |
| 563 | nu hat (MLE)                                                                                                                 | 224.5   | nu star (bias corrected)                                        |   |                                         |   |   |   | 141.6   |   |   |
| 564 | MLE Mean (bias corrected)                                                                                                    | 0.0381  | MLE Sd (bias corrected)                                         |   |                                         |   |   |   | 0.0128  |   |   |
| 565 |                                                                                                                              |         | Approximate Chi Square Value (0.05)                             |   |                                         |   |   |   | 115.1   |   |   |
| 566 | Adjusted Level of Significance                                                                                               | 0.0195  | Adjusted Chi Square Value                                       |   |                                         |   |   |   | 109.1   |   |   |
| 567 |                                                                                                                              |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 568 | <b>Assuming Gamma Distribution</b>                                                                                           |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 569 | 95% Approximate Gamma UCL (use when n>=50)                                                                                   | 0.0469  | 95% Adjusted Gamma UCL (use when n<50)                          |   |                                         |   |   |   | 0.0495  |   |   |
| 570 |                                                                                                                              |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 571 | <b>Lognormal GOF Test</b>                                                                                                    |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 572 | Shapiro Wilk Test Statistic                                                                                                  | 0.962   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |                                         |   |   |   |         |   |   |
| 573 | 5% Shapiro Wilk Critical Value                                                                                               | 0.818   | Data appear Lognormal at 5% Significance Level                  |   |                                         |   |   |   |         |   |   |
| 574 | Lilliefors Test Statistic                                                                                                    | 0.18    | <b>Lilliefors Lognormal GOF Test</b>                            |   |                                         |   |   |   |         |   |   |
| 575 | 5% Lilliefors Critical Value                                                                                                 | 0.283   | Data appear Lognormal at 5% Significance Level                  |   |                                         |   |   |   |         |   |   |
| 576 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                        |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 577 |                                                                                                                              |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 578 | <b>Lognormal Statistics</b>                                                                                                  |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 579 | Minimum of Logged Data                                                                                                       | -3.735  | Mean of logged Data                                             |   |                                         |   |   |   | -3.303  |   |   |
| 580 | Maximum of Logged Data                                                                                                       | -2.844  | SD of logged Data                                               |   |                                         |   |   |   | 0.287   |   |   |
| 581 |                                                                                                                              |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 582 | <b>Assuming Lognormal Distribution</b>                                                                                       |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 583 | 95% H-UCL                                                                                                                    | 0.0478  | 90% Chebyshev (MVUE) UCL                                        |   |                                         |   |   |   | 0.0498  |   |   |
| 584 | 95% Chebyshev (MVUE) UCL                                                                                                     | 0.0551  | 97.5% Chebyshev (MVUE) UCL                                      |   |                                         |   |   |   | 0.0624  |   |   |
| 585 | 99% Chebyshev (MVUE) UCL                                                                                                     | 0.0768  |                                                                 |   |                                         |   |   |   |         |   |   |
| 586 |                                                                                                                              |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 587 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                        |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 588 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                             |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 589 |                                                                                                                              |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 590 | <b>Nonparametric Distribution Free UCLs</b>                                                                                  |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 591 | 95% CLT UCL                                                                                                                  | 0.0445  | 95% Jackknife UCL                                               |   |                                         |   |   |   | 0.0455  |   |   |
| 592 | 95% Standard Bootstrap UCL                                                                                                   | 0.0441  | 95% Bootstrap-t UCL                                             |   |                                         |   |   |   | 0.048   |   |   |
| 593 | 95% Hall's Bootstrap UCL                                                                                                     | 0.0548  | 95% Percentile Bootstrap UCL                                    |   |                                         |   |   |   | 0.0443  |   |   |
| 594 | 95% BCA Bootstrap UCL                                                                                                        | 0.0448  |                                                                 |   |                                         |   |   |   |         |   |   |
| 595 | 90% Chebyshev(Mean, Sd) UCL                                                                                                  | 0.0498  | 95% Chebyshev(Mean, Sd) UCL                                     |   |                                         |   |   |   | 0.0551  |   |   |
| 596 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                | 0.0625  | 99% Chebyshev(Mean, Sd) UCL                                     |   |                                         |   |   |   | 0.0769  |   |   |
| 597 |                                                                                                                              |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 598 | <b>Suggested UCL to Use</b>                                                                                                  |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 599 | 95% Student's-t UCL                                                                                                          | 0.0455  |                                                                 |   |                                         |   |   |   |         |   |   |
| 600 |                                                                                                                              |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 601 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 602 | Recommendations are based upon data size, data distribution, and skewness.                                                   |         |                                                                 |   |                                         |   |   |   |         |   |   |
| 603 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).     |         |                                                                 |   |                                         |   |   |   |         |   |   |

| A   | B                                                                                                                                        | C      | D                                                               | E      | F | G | H | I | J | K | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------------------|--------|---|---|---|---|---|---|---|
| 604 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |                                                                 |        |   |   |   |   |   |   |   |
| 605 |                                                                                                                                          |        |                                                                 |        |   |   |   |   |   |   |   |
| 606 | <b>Result (eu8_strontium)</b>                                                                                                            |        |                                                                 |        |   |   |   |   |   |   |   |
| 607 |                                                                                                                                          |        |                                                                 |        |   |   |   |   |   |   |   |
| 608 | <b>General Statistics</b>                                                                                                                |        |                                                                 |        |   |   |   |   |   |   |   |
| 609 | Total Number of Observations                                                                                                             | 8      | Number of Distinct Observations                                 | 8      |   |   |   |   |   |   |   |
| 610 | Number of Detects                                                                                                                        | 7      | Number of Non-Detects                                           | 1      |   |   |   |   |   |   |   |
| 611 | Number of Distinct Detects                                                                                                               | 7      | Number of Distinct Non-Detects                                  | 1      |   |   |   |   |   |   |   |
| 612 | Minimum Detect                                                                                                                           | 0.272  | Minimum Non-Detect                                              | 0.215  |   |   |   |   |   |   |   |
| 613 | Maximum Detect                                                                                                                           | 0.893  | Maximum Non-Detect                                              | 0.215  |   |   |   |   |   |   |   |
| 614 | Variance Detects                                                                                                                         | 0.0611 | Percent Non-Detects                                             | 12.5%  |   |   |   |   |   |   |   |
| 615 | Mean Detects                                                                                                                             | 0.491  | SD Detects                                                      | 0.247  |   |   |   |   |   |   |   |
| 616 | Median Detects                                                                                                                           | 0.357  | CV Detects                                                      | 0.504  |   |   |   |   |   |   |   |
| 617 | Skewness Detects                                                                                                                         | 0.746  | Kurtosis Detects                                                | -1.151 |   |   |   |   |   |   |   |
| 618 | Mean of Logged Detects                                                                                                                   | -0.817 | SD of Logged Detects                                            | 0.49   |   |   |   |   |   |   |   |
| 619 |                                                                                                                                          |        |                                                                 |        |   |   |   |   |   |   |   |
| 620 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |        |                                                                 |        |   |   |   |   |   |   |   |
| 621 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |        |                                                                 |        |   |   |   |   |   |   |   |
| 622 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |        |                                                                 |        |   |   |   |   |   |   |   |
| 623 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |        |                                                                 |        |   |   |   |   |   |   |   |
| 624 |                                                                                                                                          |        |                                                                 |        |   |   |   |   |   |   |   |
| 625 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |        |                                                                 |        |   |   |   |   |   |   |   |
| 626 | Shapiro Wilk Test Statistic                                                                                                              | 0.846  | <b>Shapiro Wilk GOF Test</b>                                    |        |   |   |   |   |   |   |   |
| 627 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.803  | Detected Data appear Normal at 5% Significance Level            |        |   |   |   |   |   |   |   |
| 628 | Lilliefors Test Statistic                                                                                                                | 0.277  | <b>Lilliefors GOF Test</b>                                      |        |   |   |   |   |   |   |   |
| 629 | 5% Lilliefors Critical Value                                                                                                             | 0.304  | Detected Data appear Normal at 5% Significance Level            |        |   |   |   |   |   |   |   |
| 630 | <b>Detected Data appear Normal at 5% Significance Level</b>                                                                              |        |                                                                 |        |   |   |   |   |   |   |   |
| 631 |                                                                                                                                          |        |                                                                 |        |   |   |   |   |   |   |   |
| 632 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |        |                                                                 |        |   |   |   |   |   |   |   |
| 633 | KM Mean                                                                                                                                  | 0.456  | KM Standard Error of Mean                                       | 0.0889 |   |   |   |   |   |   |   |
| 634 | KM SD                                                                                                                                    | 0.233  | 95% KM (BCA) UCL                                                | 0.61   |   |   |   |   |   |   |   |
| 635 | 95% KM (t) UCL                                                                                                                           | 0.624  | 95% KM (Percentile Bootstrap) UCL                               | 0.6    |   |   |   |   |   |   |   |
| 636 | 95% KM (z) UCL                                                                                                                           | 0.602  | 95% KM Bootstrap t UCL                                          | 0.69   |   |   |   |   |   |   |   |
| 637 | 90% KM Chebyshev UCL                                                                                                                     | 0.723  | 95% KM Chebyshev UCL                                            | 0.843  |   |   |   |   |   |   |   |
| 638 | 97.5% KM Chebyshev UCL                                                                                                                   | 1.011  | 99% KM Chebyshev UCL                                            | 1.34   |   |   |   |   |   |   |   |
| 639 |                                                                                                                                          |        |                                                                 |        |   |   |   |   |   |   |   |
| 640 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |        |                                                                 |        |   |   |   |   |   |   |   |
| 641 | A-D Test Statistic                                                                                                                       | 0.577  | <b>Anderson-Darling GOF Test</b>                                |        |   |   |   |   |   |   |   |
| 642 | 5% A-D Critical Value                                                                                                                    | 0.71   | detected data appear Gamma Distributed at 5% Significance Level |        |   |   |   |   |   |   |   |
| 643 | K-S Test Statistic                                                                                                                       | 0.268  | <b>Kolmogorov-Smirnov GOF</b>                                   |        |   |   |   |   |   |   |   |
| 644 | 5% K-S Critical Value                                                                                                                    | 0.313  | detected data appear Gamma Distributed at 5% Significance Level |        |   |   |   |   |   |   |   |
| 645 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |        |                                                                 |        |   |   |   |   |   |   |   |
| 646 |                                                                                                                                          |        |                                                                 |        |   |   |   |   |   |   |   |
| 647 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |        |                                                                 |        |   |   |   |   |   |   |   |
| 648 | k hat (MLE)                                                                                                                              | 4.905  | k star (bias corrected MLE)                                     | 2.898  |   |   |   |   |   |   |   |
| 649 | Theta hat (MLE)                                                                                                                          | 0.1    | Theta star (bias corrected MLE)                                 | 0.169  |   |   |   |   |   |   |   |
| 650 | nu hat (MLE)                                                                                                                             | 68.67  | nu star (bias corrected)                                        | 40.57  |   |   |   |   |   |   |   |
| 651 | Mean (detects)                                                                                                                           | 0.491  |                                                                 |        |   |   |   |   |   |   |   |
| 652 |                                                                                                                                          |        |                                                                 |        |   |   |   |   |   |   |   |
| 653 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |        |                                                                 |        |   |   |   |   |   |   |   |
| 654 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |        |                                                                 |        |   |   |   |   |   |   |   |
| 655 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |        |                                                                 |        |   |   |   |   |   |   |   |
| 656 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |        |                                                                 |        |   |   |   |   |   |   |   |
| 657 | This is especially true when the sample size is small.                                                                                   |        |                                                                 |        |   |   |   |   |   |   |   |
| 658 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |        |                                                                 |        |   |   |   |   |   |   |   |
| 659 | Minimum                                                                                                                                  | 0.0211 | Mean                                                            | 0.432  |   |   |   |   |   |   |   |
| 660 | Maximum                                                                                                                                  | 0.893  | Median                                                          | 0.327  |   |   |   |   |   |   |   |
| 661 | SD                                                                                                                                       | 0.283  | CV                                                              | 0.655  |   |   |   |   |   |   |   |
| 662 | k hat (MLE)                                                                                                                              | 1.543  | k star (bias corrected MLE)                                     | 1.047  |   |   |   |   |   |   |   |
| 663 | Theta hat (MLE)                                                                                                                          | 0.28   | Theta star (bias corrected MLE)                                 | 0.412  |   |   |   |   |   |   |   |
| 664 | nu hat (MLE)                                                                                                                             | 24.68  | nu star (bias corrected)                                        | 16.76  |   |   |   |   |   |   |   |
| 665 | Adjusted Level of Significance ( $\beta$ )                                                                                               | 0.0195 |                                                                 |        |   |   |   |   |   |   |   |
| 666 | Approximate Chi Square Value (16.76, $\alpha$ )                                                                                          | 8.501  | Adjusted Chi Square Value (16.76, $\beta$ )                     | 7.065  |   |   |   |   |   |   |   |
| 667 | 95% Gamma Approximate UCL (use when n>=50)                                                                                               | 0.852  | 95% Gamma Adjusted UCL (use when n<50)                          | 1.025  |   |   |   |   |   |   |   |
| 668 |                                                                                                                                          |        |                                                                 |        |   |   |   |   |   |   |   |
| 669 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |        |                                                                 |        |   |   |   |   |   |   |   |
| 670 | Mean (KM)                                                                                                                                | 0.456  | SD (KM)                                                         | 0.233  |   |   |   |   |   |   |   |

| A   | B | C | D                                                                                                                                        | E | F      | G                           | H | I | J                                                       | K | L      |
|-----|---|---|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|-----------------------------|---|---|---------------------------------------------------------|---|--------|
| 671 |   |   | Variance (KM)                                                                                                                            |   | 0.0541 |                             |   |   | SE of Mean (KM)                                         |   | 0.0889 |
| 672 |   |   | k hat (KM)                                                                                                                               |   | 3.844  |                             |   |   | k star (KM)                                             |   | 2.486  |
| 673 |   |   | nu hat (KM)                                                                                                                              |   | 61.5   |                             |   |   | nu star (KM)                                            |   | 39.77  |
| 674 |   |   | theta hat (KM)                                                                                                                           |   | 0.119  |                             |   |   | theta star (KM)                                         |   | 0.184  |
| 675 |   |   | 80% gamma percentile (KM)                                                                                                                |   | 0.665  |                             |   |   | 90% gamma percentile (KM)                               |   | 0.844  |
| 676 |   |   | 95% gamma percentile (KM)                                                                                                                |   | 1.012  |                             |   |   | 99% gamma percentile (KM)                               |   | 1.38   |
| 677 |   |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |   |        |                             |   |   |                                                         |   |        |
| 678 |   |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |   |        |                             |   |   |                                                         |   |        |
| 679 |   |   | Approximate Chi Square Value (39.77, $\alpha$ )                                                                                          |   | 26.32  |                             |   |   | Adjusted Chi Square Value (39.77, $\beta$ )             |   | 23.59  |
| 680 |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                      |   | 0.689  |                             |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )          |   | 0.769  |
| 681 |   |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |   |        |                             |   |   |                                                         |   |        |
| 682 |   |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |   |        |                             |   |   |                                                         |   |        |
| 683 |   |   | Shapiro Wilk Test Statistic                                                                                                              |   | 0.858  |                             |   |   | Shapiro Wilk GOF Test                                   |   |        |
| 684 |   |   | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.803  |                             |   |   | Detected Data appear Lognormal at 5% Significance Level |   |        |
| 685 |   |   | Lilliefors Test Statistic                                                                                                                |   | 0.239  |                             |   |   | Lilliefors GOF Test                                     |   |        |
| 686 |   |   | 5% Lilliefors Critical Value                                                                                                             |   | 0.304  |                             |   |   | Detected Data appear Lognormal at 5% Significance Level |   |        |
| 687 |   |   | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                           |   |        |                             |   |   |                                                         |   |        |
| 688 |   |   | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                           |   |        |                             |   |   |                                                         |   |        |
| 689 |   |   | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |   |        |                             |   |   |                                                         |   |        |
| 690 |   |   | Mean in Original Scale                                                                                                                   |   | 0.446  |                             |   |   | Mean in Log Scale                                       |   | -0.966 |
| 691 |   |   | SD in Original Scale                                                                                                                     |   | 0.261  |                             |   |   | SD in Log Scale                                         |   | 0.619  |
| 692 |   |   | 95% t UCL (assumes normality of ROS data)                                                                                                |   | 0.621  |                             |   |   | 95% Percentile Bootstrap UCL                            |   | 0.591  |
| 693 |   |   | 95% BCA Bootstrap UCL                                                                                                                    |   | 0.603  |                             |   |   | 95% Bootstrap t UCL                                     |   | 0.666  |
| 694 |   |   | 95% H-UCL (Log ROS)                                                                                                                      |   | 0.841  |                             |   |   |                                                         |   |        |
| 695 |   |   | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |        |                             |   |   |                                                         |   |        |
| 696 |   |   | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |        |                             |   |   |                                                         |   |        |
| 697 |   |   | KM Mean (logged)                                                                                                                         |   | -0.907 |                             |   |   | KM Geo Mean                                             |   | 0.404  |
| 698 |   |   | KM SD (logged)                                                                                                                           |   | 0.487  |                             |   |   | 95% Critical H Value (KM-Log)                           |   | 2.332  |
| 699 |   |   | KM Standard Error of Mean (logged)                                                                                                       |   | 0.186  |                             |   |   | 95% H-UCL (KM -Log)                                     |   | 0.698  |
| 700 |   |   | KM SD (logged)                                                                                                                           |   | 0.487  |                             |   |   | 95% Critical H Value (KM-Log)                           |   | 2.332  |
| 701 |   |   | KM Standard Error of Mean (logged)                                                                                                       |   | 0.186  |                             |   |   |                                                         |   |        |
| 702 |   |   | <b>DL/2 Statistics</b>                                                                                                                   |   |        |                             |   |   |                                                         |   |        |
| 703 |   |   | <b>DL/2 Statistics</b>                                                                                                                   |   |        |                             |   |   |                                                         |   |        |
| 704 |   |   | <b>DL/2 Normal</b>                                                                                                                       |   |        | <b>DL/2 Log-Transformed</b> |   |   |                                                         |   |        |
| 705 |   |   | Mean in Original Scale                                                                                                                   |   | 0.443  |                             |   |   | Mean in Log Scale                                       |   | -0.994 |
| 706 |   |   | SD in Original Scale                                                                                                                     |   | 0.266  |                             |   |   | SD in Log Scale                                         |   | 0.675  |
| 707 |   |   | 95% t UCL (Assumes normality)                                                                                                            |   | 0.621  |                             |   |   | 95% H-Stat UCL                                          |   | 0.921  |
| 708 |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |        |                             |   |   |                                                         |   |        |
| 709 |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |        |                             |   |   |                                                         |   |        |
| 710 |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |        |                             |   |   |                                                         |   |        |
| 711 |   |   | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                  |   |        |                             |   |   |                                                         |   |        |
| 712 |   |   | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                  |   |        |                             |   |   |                                                         |   |        |
| 713 |   |   | <b>Suggested UCL to Use</b>                                                                                                              |   |        |                             |   |   |                                                         |   |        |
| 714 |   |   | 95% KM (t) UCL                                                                                                                           |   | 0.624  |                             |   |   |                                                         |   |        |
| 715 |   |   | <b>Suggested UCL to Use</b>                                                                                                              |   |        |                             |   |   |                                                         |   |        |
| 716 |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |                             |   |   |                                                         |   |        |
| 717 |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |                             |   |   |                                                         |   |        |
| 718 |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |                             |   |   |                                                         |   |        |
| 719 |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |                             |   |   |                                                         |   |        |
| 720 |   |   | <b>Result (eu8_thallium)</b>                                                                                                             |   |        |                             |   |   |                                                         |   |        |
| 721 |   |   | <b>Result (eu8_thallium)</b>                                                                                                             |   |        |                             |   |   |                                                         |   |        |
| 722 |   |   | <b>Result (eu8_thallium)</b>                                                                                                             |   |        |                             |   |   |                                                         |   |        |
| 723 |   |   | <b>General Statistics</b>                                                                                                                |   |        |                             |   |   |                                                         |   |        |
| 724 |   |   | Total Number of Observations                                                                                                             |   | 8      |                             |   |   | Number of Distinct Observations                         |   | 8      |
| 725 |   |   | Number of Detects                                                                                                                        |   | 0      |                             |   |   | Number of Non-Detects                                   |   | 8      |
| 726 |   |   | Number of Distinct Detects                                                                                                               |   | 0      |                             |   |   | Number of Distinct Non-Detects                          |   | 8      |
| 727 |   |   | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                       |   |        |                             |   |   |                                                         |   |        |
| 728 |   |   | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                       |   |        |                             |   |   |                                                         |   |        |
| 729 |   |   | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>                 |   |        |                             |   |   |                                                         |   |        |
| 730 |   |   | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>        |   |        |                             |   |   |                                                         |   |        |
| 731 |   |   | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>        |   |        |                             |   |   |                                                         |   |        |
| 732 |   |   | <b>The data set for variable Result (eu8_thallium) was not processed!</b>                                                                |   |        |                             |   |   |                                                         |   |        |
| 733 |   |   | <b>The data set for variable Result (eu8_thallium) was not processed!</b>                                                                |   |        |                             |   |   |                                                         |   |        |
| 734 |   |   | <b>The data set for variable Result (eu8_thallium) was not processed!</b>                                                                |   |        |                             |   |   |                                                         |   |        |
| 735 |   |   | <b>The data set for variable Result (eu8_thallium) was not processed!</b>                                                                |   |        |                             |   |   |                                                         |   |        |
| 736 |   |   | <b>Result (eu8_zinc)</b>                                                                                                                 |   |        |                             |   |   |                                                         |   |        |
| 737 |   |   | <b>Result (eu8_zinc)</b>                                                                                                                 |   |        |                             |   |   |                                                         |   |        |

|     | A                                                                                                          | B | C | D      | E | F                                                               | G                                       | H | I     | J     | K | L |
|-----|------------------------------------------------------------------------------------------------------------|---|---|--------|---|-----------------------------------------------------------------|-----------------------------------------|---|-------|-------|---|---|
| 738 | <b>General Statistics</b>                                                                                  |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 739 | Total Number of Observations                                                                               |   |   | 8      |   | Number of Distinct Observations                                 |                                         |   | 8     |       |   |   |
| 740 |                                                                                                            |   |   |        |   |                                                                 | Number of Missing Observations          |   |       | 0     |   |   |
| 741 | Minimum                                                                                                    |   |   | 6.192  |   | Mean                                                            |                                         |   | 8.639 |       |   |   |
| 742 | Maximum                                                                                                    |   |   | 13.21  |   | Median                                                          |                                         |   | 8.386 |       |   |   |
| 743 | SD                                                                                                         |   |   | 2.154  |   | Std. Error of Mean                                              |                                         |   | 0.761 |       |   |   |
| 744 | Coefficient of Variation                                                                                   |   |   | 0.249  |   | Skewness                                                        |                                         |   | 1.345 |       |   |   |
| 745 |                                                                                                            |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 746 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b> |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 747 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>     |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 748 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                        |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 749 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>             |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 750 |                                                                                                            |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 751 | <b>Normal GOF Test</b>                                                                                     |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 752 | Shapiro Wilk Test Statistic                                                                                |   |   | 0.859  |   | <b>Shapiro Wilk GOF Test</b>                                    |                                         |   |       |       |   |   |
| 753 | 5% Shapiro Wilk Critical Value                                                                             |   |   | 0.818  |   | Data appear Normal at 5% Significance Level                     |                                         |   |       |       |   |   |
| 754 | Lilliefors Test Statistic                                                                                  |   |   | 0.276  |   | <b>Lilliefors GOF Test</b>                                      |                                         |   |       |       |   |   |
| 755 | 5% Lilliefors Critical Value                                                                               |   |   | 0.283  |   | Data appear Normal at 5% Significance Level                     |                                         |   |       |       |   |   |
| 756 | <b>Data appear Normal at 5% Significance Level</b>                                                         |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 757 |                                                                                                            |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 758 | <b>Assuming Normal Distribution</b>                                                                        |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 759 | <b>95% Normal UCL</b>                                                                                      |   |   |        |   |                                                                 | <b>95% UCLs (Adjusted for Skewness)</b> |   |       |       |   |   |
| 760 | 95% Student's-t UCL                                                                                        |   |   | 10.08  |   | 95% Adjusted-CLT UCL (Chen-1995)                                |                                         |   | 10.28 |       |   |   |
| 761 |                                                                                                            |   |   |        |   |                                                                 | 95% Modified-t UCL (Johnson-1978)       |   |       | 10.14 |   |   |
| 762 |                                                                                                            |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 763 | <b>Gamma GOF Test</b>                                                                                      |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 764 | A-D Test Statistic                                                                                         |   |   | 0.455  |   | <b>Anderson-Darling Gamma GOF Test</b>                          |                                         |   |       |       |   |   |
| 765 | 5% A-D Critical Value                                                                                      |   |   | 0.716  |   | detected data appear Gamma Distributed at 5% Significance Level |                                         |   |       |       |   |   |
| 766 | K-S Test Statistic                                                                                         |   |   | 0.238  |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |                                         |   |       |       |   |   |
| 767 | 5% K-S Critical Value                                                                                      |   |   | 0.294  |   | detected data appear Gamma Distributed at 5% Significance Level |                                         |   |       |       |   |   |
| 768 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                     |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 769 |                                                                                                            |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 770 | <b>Gamma Statistics</b>                                                                                    |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 771 | k hat (MLE)                                                                                                |   |   | 20.35  |   | k star (bias corrected MLE)                                     |                                         |   | 12.8  |       |   |   |
| 772 | Theta hat (MLE)                                                                                            |   |   | 0.425  |   | Theta star (bias corrected MLE)                                 |                                         |   | 0.675 |       |   |   |
| 773 | nu hat (MLE)                                                                                               |   |   | 325.6  |   | nu star (bias corrected)                                        |                                         |   | 204.8 |       |   |   |
| 774 | MLE Mean (bias corrected)                                                                                  |   |   | 8.639  |   | MLE Sd (bias corrected)                                         |                                         |   | 2.414 |       |   |   |
| 775 |                                                                                                            |   |   |        |   |                                                                 | Approximate Chi Square Value (0.05)     |   |       | 172.7 |   |   |
| 776 | Adjusted Level of Significance                                                                             |   |   | 0.0195 |   | Adjusted Chi Square Value                                       |                                         |   | 165.2 |       |   |   |
| 777 |                                                                                                            |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 778 | <b>Assuming Gamma Distribution</b>                                                                         |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 779 | 95% Approximate Gamma UCL (use when n>=50)                                                                 |   |   | 10.25  |   | 95% Adjusted Gamma UCL (use when n<50)                          |                                         |   | 10.71 |       |   |   |
| 780 |                                                                                                            |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 781 | <b>Lognormal GOF Test</b>                                                                                  |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 782 | Shapiro Wilk Test Statistic                                                                                |   |   | 0.911  |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |                                         |   |       |       |   |   |
| 783 | 5% Shapiro Wilk Critical Value                                                                             |   |   | 0.818  |   | Data appear Lognormal at 5% Significance Level                  |                                         |   |       |       |   |   |
| 784 | Lilliefors Test Statistic                                                                                  |   |   | 0.232  |   | <b>Lilliefors Lognormal GOF Test</b>                            |                                         |   |       |       |   |   |
| 785 | 5% Lilliefors Critical Value                                                                               |   |   | 0.283  |   | Data appear Lognormal at 5% Significance Level                  |                                         |   |       |       |   |   |
| 786 | <b>Data appear Lognormal at 5% Significance Level</b>                                                      |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 787 |                                                                                                            |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 788 | <b>Lognormal Statistics</b>                                                                                |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 789 | Minimum of Logged Data                                                                                     |   |   | 1.823  |   | Mean of logged Data                                             |                                         |   | 2.132 |       |   |   |
| 790 | Maximum of Logged Data                                                                                     |   |   | 2.581  |   | SD of logged Data                                               |                                         |   | 0.234 |       |   |   |
| 791 |                                                                                                            |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 792 | <b>Assuming Lognormal Distribution</b>                                                                     |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 793 | 95% H-UCL                                                                                                  |   |   | 10.31  |   | 90% Chebyshev (MVUE) UCL                                        |                                         |   | 10.77 |       |   |   |
| 794 | 95% Chebyshev (MVUE) UCL                                                                                   |   |   | 11.75  |   | 97.5% Chebyshev (MVUE) UCL                                      |                                         |   | 13.09 |       |   |   |
| 795 | 99% Chebyshev (MVUE) UCL                                                                                   |   |   | 15.74  |   |                                                                 |                                         |   |       |       |   |   |
| 796 |                                                                                                            |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 797 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                      |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 798 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                           |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 799 |                                                                                                            |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 800 | <b>Nonparametric Distribution Free UCLs</b>                                                                |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 801 | 95% CLT UCL                                                                                                |   |   | 9.891  |   | 95% Jackknife UCL                                               |                                         |   | 10.08 |       |   |   |
| 802 | 95% Standard Bootstrap UCL                                                                                 |   |   | 9.775  |   | 95% Bootstrap-t UCL                                             |                                         |   | 10.52 |       |   |   |
| 803 | 95% Hall's Bootstrap UCL                                                                                   |   |   | 16.67  |   | 95% Percentile Bootstrap UCL                                    |                                         |   | 9.923 |       |   |   |
| 804 | 95% BCA Bootstrap UCL                                                                                      |   |   | 10.18  |   |                                                                 |                                         |   |       |       |   |   |

| A   | B                                                                                                                                        | C | D | E | F     | G                               | H | I | J | K     | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|-------|---------------------------------|---|---|---|-------|---|
| 805 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   |   | 10.92 | 95% Chebyshev(Mean, Sd) UCL     |   |   |   | 11.96 |   |
| 806 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   |   | 13.39 | 99% Chebyshev(Mean, Sd) UCL     |   |   |   | 16.21 |   |
| 807 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |
| 808 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |   |       |                                 |   |   |   |       |   |
| 809 | 95% Student's-t UCL                                                                                                                      |   |   |   | 10.08 |                                 |   |   |   |       |   |
| 810 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |
| 811 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |   |       |                                 |   |   |   |       |   |
| 812 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |   |       |                                 |   |   |   |       |   |
| 813 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |   |       |                                 |   |   |   |       |   |
| 814 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |   |       |                                 |   |   |   |       |   |
| 815 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |
| 816 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |
| 817 | <b>Result (eu9_aluminum)</b>                                                                                                             |   |   |   |       |                                 |   |   |   |       |   |
| 818 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |
| 819 | <b>General Statistics</b>                                                                                                                |   |   |   |       |                                 |   |   |   |       |   |
| 820 | Total Number of Observations                                                                                                             |   |   |   | 5     | Number of Distinct Observations |   |   |   | 5     |   |
| 821 | Number of Detects                                                                                                                        |   |   |   | 0     | Number of Non-Detects           |   |   |   | 5     |   |
| 822 | Number of Distinct Detects                                                                                                               |   |   |   | 0     | Number of Distinct Non-Detects  |   |   |   | 5     |   |
| 823 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |
| 824 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                       |   |   |   |       |                                 |   |   |   |       |   |
| 825 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>                 |   |   |   |       |                                 |   |   |   |       |   |
| 826 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>        |   |   |   |       |                                 |   |   |   |       |   |
| 827 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |
| 828 | <b>The data set for variable Result (eu9_aluminum) was not processed!</b>                                                                |   |   |   |       |                                 |   |   |   |       |   |
| 829 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |
| 830 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |
| 831 | <b>Result (eu9_antimony)</b>                                                                                                             |   |   |   |       |                                 |   |   |   |       |   |
| 832 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |
| 833 | <b>General Statistics</b>                                                                                                                |   |   |   |       |                                 |   |   |   |       |   |
| 834 | Total Number of Observations                                                                                                             |   |   |   | 5     | Number of Distinct Observations |   |   |   | 5     |   |
| 835 | Number of Detects                                                                                                                        |   |   |   | 0     | Number of Non-Detects           |   |   |   | 5     |   |
| 836 | Number of Distinct Detects                                                                                                               |   |   |   | 0     | Number of Distinct Non-Detects  |   |   |   | 5     |   |
| 837 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |
| 838 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                       |   |   |   |       |                                 |   |   |   |       |   |
| 839 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>                 |   |   |   |       |                                 |   |   |   |       |   |
| 840 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>        |   |   |   |       |                                 |   |   |   |       |   |
| 841 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |
| 842 | <b>The data set for variable Result (eu9_antimony) was not processed!</b>                                                                |   |   |   |       |                                 |   |   |   |       |   |
| 843 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |
| 844 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |
| 845 | <b>Result (eu9_arsenic)</b>                                                                                                              |   |   |   |       |                                 |   |   |   |       |   |
| 846 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |
| 847 | <b>General Statistics</b>                                                                                                                |   |   |   |       |                                 |   |   |   |       |   |
| 848 | Total Number of Observations                                                                                                             |   |   |   | 5     | Number of Distinct Observations |   |   |   | 5     |   |
| 849 | Number of Detects                                                                                                                        |   |   |   | 0     | Number of Non-Detects           |   |   |   | 5     |   |
| 850 | Number of Distinct Detects                                                                                                               |   |   |   | 0     | Number of Distinct Non-Detects  |   |   |   | 5     |   |
| 851 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |
| 852 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                       |   |   |   |       |                                 |   |   |   |       |   |
| 853 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>                 |   |   |   |       |                                 |   |   |   |       |   |
| 854 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>        |   |   |   |       |                                 |   |   |   |       |   |
| 855 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |
| 856 | <b>The data set for variable Result (eu9_arsenic) was not processed!</b>                                                                 |   |   |   |       |                                 |   |   |   |       |   |
| 857 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |
| 858 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |
| 859 | <b>Result (eu9_beryllium)</b>                                                                                                            |   |   |   |       |                                 |   |   |   |       |   |
| 860 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |
| 861 | <b>General Statistics</b>                                                                                                                |   |   |   |       |                                 |   |   |   |       |   |
| 862 | Total Number of Observations                                                                                                             |   |   |   | 5     | Number of Distinct Observations |   |   |   | 5     |   |
| 863 | Number of Detects                                                                                                                        |   |   |   | 0     | Number of Non-Detects           |   |   |   | 5     |   |
| 864 | Number of Distinct Detects                                                                                                               |   |   |   | 0     | Number of Distinct Non-Detects  |   |   |   | 5     |   |
| 865 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |
| 866 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                       |   |   |   |       |                                 |   |   |   |       |   |
| 867 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>                 |   |   |   |       |                                 |   |   |   |       |   |
| 868 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>        |   |   |   |       |                                 |   |   |   |       |   |
| 869 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |
| 870 | <b>The data set for variable Result (eu9_beryllium) was not processed!</b>                                                               |   |   |   |       |                                 |   |   |   |       |   |
| 871 |                                                                                                                                          |   |   |   |       |                                 |   |   |   |       |   |

|     | A                                                                                                          | B | C | D      | E | F | G                                                             | H | I | J      | K | L |
|-----|------------------------------------------------------------------------------------------------------------|---|---|--------|---|---|---------------------------------------------------------------|---|---|--------|---|---|
| 872 |                                                                                                            |   |   |        |   |   |                                                               |   |   |        |   |   |
| 873 |                                                                                                            |   |   |        |   |   |                                                               |   |   |        |   |   |
| 874 | <b>Result (eu9_cadmium)</b>                                                                                |   |   |        |   |   |                                                               |   |   |        |   |   |
| 875 |                                                                                                            |   |   |        |   |   |                                                               |   |   |        |   |   |
| 876 | <b>General Statistics</b>                                                                                  |   |   |        |   |   |                                                               |   |   |        |   |   |
| 877 | Total Number of Observations                                                                               |   |   | 5      |   |   | Number of Distinct Observations                               |   |   | 5      |   |   |
| 878 |                                                                                                            |   |   |        |   |   | Number of Missing Observations                                |   |   | 0      |   |   |
| 879 | Minimum                                                                                                    |   |   | 0.019  |   |   | Mean                                                          |   |   | 0.0541 |   |   |
| 880 | Maximum                                                                                                    |   |   | 0.0802 |   |   | Median                                                        |   |   | 0.067  |   |   |
| 881 | SD                                                                                                         |   |   | 0.0286 |   |   | Std. Error of Mean                                            |   |   | 0.0128 |   |   |
| 882 | Coefficient of Variation                                                                                   |   |   | 0.53   |   |   | Skewness                                                      |   |   | -0.535 |   |   |
| 883 |                                                                                                            |   |   |        |   |   |                                                               |   |   |        |   |   |
| 884 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b> |   |   |        |   |   |                                                               |   |   |        |   |   |
| 885 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>     |   |   |        |   |   |                                                               |   |   |        |   |   |
| 886 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                        |   |   |        |   |   |                                                               |   |   |        |   |   |
| 887 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>             |   |   |        |   |   |                                                               |   |   |        |   |   |
| 888 |                                                                                                            |   |   |        |   |   |                                                               |   |   |        |   |   |
| 889 | <b>Normal GOF Test</b>                                                                                     |   |   |        |   |   |                                                               |   |   |        |   |   |
| 890 | Shapiro Wilk Test Statistic                                                                                |   |   | 0.839  |   |   | <b>Shapiro Wilk GOF Test</b>                                  |   |   |        |   |   |
| 891 | 5% Shapiro Wilk Critical Value                                                                             |   |   | 0.762  |   |   | Data appear Normal at 5% Significance Level                   |   |   |        |   |   |
| 892 | Lilliefors Test Statistic                                                                                  |   |   | 0.274  |   |   | <b>Lilliefors GOF Test</b>                                    |   |   |        |   |   |
| 893 | 5% Lilliefors Critical Value                                                                               |   |   | 0.343  |   |   | Data appear Normal at 5% Significance Level                   |   |   |        |   |   |
| 894 | <b>Data appear Normal at 5% Significance Level</b>                                                         |   |   |        |   |   |                                                               |   |   |        |   |   |
| 895 |                                                                                                            |   |   |        |   |   |                                                               |   |   |        |   |   |
| 896 | <b>Assuming Normal Distribution</b>                                                                        |   |   |        |   |   |                                                               |   |   |        |   |   |
| 897 | <b>95% Normal UCL</b>                                                                                      |   |   |        |   |   | <b>95% UCLs (Adjusted for Skewness)</b>                       |   |   |        |   |   |
| 898 | 95% Student's-t UCL                                                                                        |   |   | 0.0814 |   |   | 95% Adjusted-CLT UCL (Chen-1995)                              |   |   | 0.0719 |   |   |
| 899 |                                                                                                            |   |   |        |   |   | 95% Modified-t UCL (Johnson-1978)                             |   |   | 0.0809 |   |   |
| 900 |                                                                                                            |   |   |        |   |   |                                                               |   |   |        |   |   |
| 901 | <b>Gamma GOF Test</b>                                                                                      |   |   |        |   |   |                                                               |   |   |        |   |   |
| 902 | A-D Test Statistic                                                                                         |   |   | 0.555  |   |   | <b>Anderson-Darling Gamma GOF Test</b>                        |   |   |        |   |   |
| 903 | 5% A-D Critical Value                                                                                      |   |   | 0.682  |   |   | detected data appear Gamma Distributed at 5% Significance Lev |   |   |        |   |   |
| 904 | K-S Test Statistic                                                                                         |   |   | 0.322  |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                      |   |   |        |   |   |
| 905 | 5% K-S Critical Value                                                                                      |   |   | 0.359  |   |   | detected data appear Gamma Distributed at 5% Significance Lev |   |   |        |   |   |
| 906 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                     |   |   |        |   |   |                                                               |   |   |        |   |   |
| 907 |                                                                                                            |   |   |        |   |   |                                                               |   |   |        |   |   |
| 908 | <b>Gamma Statistics</b>                                                                                    |   |   |        |   |   |                                                               |   |   |        |   |   |
| 909 | k hat (MLE)                                                                                                |   |   | 3.445  |   |   | k star (bias corrected MLE)                                   |   |   | 1.511  |   |   |
| 910 | Theta hat (MLE)                                                                                            |   |   | 0.0157 |   |   | Theta star (bias corrected MLE)                               |   |   | 0.0358 |   |   |
| 911 | nu hat (MLE)                                                                                               |   |   | 34.45  |   |   | nu star (bias corrected)                                      |   |   | 15.11  |   |   |
| 912 | MLE Mean (bias corrected)                                                                                  |   |   | 0.0541 |   |   | MLE Sd (bias corrected)                                       |   |   | 0.044  |   |   |
| 913 |                                                                                                            |   |   |        |   |   | Approximate Chi Square Value (0.05)                           |   |   | 7.341  |   |   |
| 914 | Adjusted Level of Significance                                                                             |   |   | 0.0086 |   |   | Adjusted Chi Square Value                                     |   |   | 5.149  |   |   |
| 915 |                                                                                                            |   |   |        |   |   |                                                               |   |   |        |   |   |
| 916 | <b>Assuming Gamma Distribution</b>                                                                         |   |   |        |   |   |                                                               |   |   |        |   |   |
| 917 | 95% Approximate Gamma UCL (use when n>=50))                                                                |   |   | 0.111  |   |   | 95% Adjusted Gamma UCL (use when n<50)                        |   |   | 0.159  |   |   |
| 918 |                                                                                                            |   |   |        |   |   |                                                               |   |   |        |   |   |
| 919 | <b>Lognormal GOF Test</b>                                                                                  |   |   |        |   |   |                                                               |   |   |        |   |   |
| 920 | Shapiro Wilk Test Statistic                                                                                |   |   | 0.826  |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>                        |   |   |        |   |   |
| 921 | 5% Shapiro Wilk Critical Value                                                                             |   |   | 0.762  |   |   | Data appear Lognormal at 5% Significance Level                |   |   |        |   |   |
| 922 | Lilliefors Test Statistic                                                                                  |   |   | 0.31   |   |   | <b>Lilliefors Lognormal GOF Test</b>                          |   |   |        |   |   |
| 923 | 5% Lilliefors Critical Value                                                                               |   |   | 0.343  |   |   | Data appear Lognormal at 5% Significance Level                |   |   |        |   |   |
| 924 | <b>Data appear Lognormal at 5% Significance Level</b>                                                      |   |   |        |   |   |                                                               |   |   |        |   |   |
| 925 |                                                                                                            |   |   |        |   |   |                                                               |   |   |        |   |   |
| 926 | <b>Lognormal Statistics</b>                                                                                |   |   |        |   |   |                                                               |   |   |        |   |   |
| 927 | Minimum of Logged Data                                                                                     |   |   | -3.961 |   |   | Mean of logged Data                                           |   |   | -3.069 |   |   |
| 928 | Maximum of Logged Data                                                                                     |   |   | -2.523 |   |   | SD of logged Data                                             |   |   | 0.661  |   |   |
| 929 |                                                                                                            |   |   |        |   |   |                                                               |   |   |        |   |   |
| 930 | <b>Assuming Lognormal Distribution</b>                                                                     |   |   |        |   |   |                                                               |   |   |        |   |   |
| 931 | 95% H-UCL                                                                                                  |   |   | 0.184  |   |   | 90% Chebyshev (MVUE) UCL                                      |   |   | 0.103  |   |   |
| 932 | 95% Chebyshev (MVUE) UCL                                                                                   |   |   | 0.125  |   |   | 97.5% Chebyshev (MVUE) UCL                                    |   |   | 0.155  |   |   |
| 933 | 99% Chebyshev (MVUE) UCL                                                                                   |   |   | 0.214  |   |   |                                                               |   |   |        |   |   |
| 934 |                                                                                                            |   |   |        |   |   |                                                               |   |   |        |   |   |
| 935 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                      |   |   |        |   |   |                                                               |   |   |        |   |   |
| 936 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                           |   |   |        |   |   |                                                               |   |   |        |   |   |
| 937 |                                                                                                            |   |   |        |   |   |                                                               |   |   |        |   |   |
| 938 | <b>Nonparametric Distribution Free UCLs</b>                                                                |   |   |        |   |   |                                                               |   |   |        |   |   |

| A    | B                                                                                                                                                                                                                    | C | D | E                             | F      | G                                                               | H | I | J                            | K | L      |  |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|-------------------------------|--------|-----------------------------------------------------------------|---|---|------------------------------|---|--------|--|
| 939  |                                                                                                                                                                                                                      |   |   | 95% CLT UCL                   | 0.0752 |                                                                 |   |   | 95% Jackknife UCL            |   | 0.0814 |  |
| 940  |                                                                                                                                                                                                                      |   |   | 95% Standard Bootstrap UCL    | 0.0731 |                                                                 |   |   | 95% Bootstrap-t UCL          |   | 0.0779 |  |
| 941  |                                                                                                                                                                                                                      |   |   | 95% Hall's Bootstrap UCL      | 0.0648 |                                                                 |   |   | 95% Percentile Bootstrap UCL |   | 0.0735 |  |
| 942  |                                                                                                                                                                                                                      |   |   | 95% BCA Bootstrap UCL         | 0.0697 |                                                                 |   |   |                              |   |        |  |
| 943  |                                                                                                                                                                                                                      |   |   | 90% Chebyshev(Mean, Sd) UCL   | 0.0925 |                                                                 |   |   | 95% Chebyshev(Mean, Sd) UCL  |   | 0.11   |  |
| 944  |                                                                                                                                                                                                                      |   |   | 97.5% Chebyshev(Mean, Sd) UCL | 0.134  |                                                                 |   |   | 99% Chebyshev(Mean, Sd) UCL  |   | 0.182  |  |
| 945  |                                                                                                                                                                                                                      |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 946  | <b>Suggested UCL to Use</b>                                                                                                                                                                                          |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 947  |                                                                                                                                                                                                                      |   |   | 95% Student's-t UCL           | 0.0814 |                                                                 |   |   |                              |   |        |  |
| 948  |                                                                                                                                                                                                                      |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 949  | <b>Recommended UCL exceeds the maximum observation</b>                                                                                                                                                               |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 950  |                                                                                                                                                                                                                      |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 951  | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.                                                                                         |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 952  | Recommendations are based upon data size, data distribution, and skewness.                                                                                                                                           |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 953  | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                                                                                             |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 954  | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician                                                                             |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 955  |                                                                                                                                                                                                                      |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 956  | <b>Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.</b> |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 957  |                                                                                                                                                                                                                      |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 958  |                                                                                                                                                                                                                      |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 959  |                                                                                                                                                                                                                      |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 960  | <b>Result (eu9_chromium)</b>                                                                                                                                                                                         |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 961  |                                                                                                                                                                                                                      |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 962  | <b>General Statistics</b>                                                                                                                                                                                            |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 963  | Total Number of Observations                                                                                                                                                                                         |   |   | 5                             |        | Number of Distinct Observations                                 |   |   | 5                            |   |        |  |
| 964  |                                                                                                                                                                                                                      |   |   |                               |        | Number of Missing Observations                                  |   |   | 0                            |   |        |  |
| 965  | Minimum                                                                                                                                                                                                              |   |   | 0.801                         |        | Mean                                                            |   |   | 0.991                        |   |        |  |
| 966  | Maximum                                                                                                                                                                                                              |   |   | 1.48                          |        | Median                                                          |   |   | 0.832                        |   |        |  |
| 967  | SD                                                                                                                                                                                                                   |   |   | 0.29                          |        | Std. Error of Mean                                              |   |   | 0.13                         |   |        |  |
| 968  | Coefficient of Variation                                                                                                                                                                                             |   |   | 0.293                         |        | Skewness                                                        |   |   | 1.711                        |   |        |  |
| 969  |                                                                                                                                                                                                                      |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 970  | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>           |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 971  |                                                                                                                                                                                                                      |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 972  | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                                                                                                  |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 973  | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                                                                                                       |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 974  |                                                                                                                                                                                                                      |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 975  | <b>Normal GOF Test</b>                                                                                                                                                                                               |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 976  | Shapiro Wilk Test Statistic                                                                                                                                                                                          |   |   | 0.762                         |        | <b>Shapiro Wilk GOF Test</b>                                    |   |   |                              |   |        |  |
| 977  | 5% Shapiro Wilk Critical Value                                                                                                                                                                                       |   |   | 0.762                         |        | Data Not Normal at 5% Significance Level                        |   |   |                              |   |        |  |
| 978  | Lilliefors Test Statistic                                                                                                                                                                                            |   |   | 0.307                         |        | <b>Lilliefors GOF Test</b>                                      |   |   |                              |   |        |  |
| 979  | 5% Lilliefors Critical Value                                                                                                                                                                                         |   |   | 0.343                         |        | Data appear Normal at 5% Significance Level                     |   |   |                              |   |        |  |
| 980  | <b>Data appear Approximate Normal at 5% Significance Level</b>                                                                                                                                                       |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 981  |                                                                                                                                                                                                                      |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 982  | <b>Assuming Normal Distribution</b>                                                                                                                                                                                  |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 983  | <b>95% Normal UCL</b>                                                                                                                                                                                                |   |   |                               |        | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |                              |   |        |  |
| 984  | 95% Student's-t UCL                                                                                                                                                                                                  |   |   | 1.267                         |        | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   | 1.31                         |   |        |  |
| 985  |                                                                                                                                                                                                                      |   |   |                               |        | 95% Modified-t UCL (Johnson-1978)                               |   |   | 1.284                        |   |        |  |
| 986  |                                                                                                                                                                                                                      |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 987  | <b>Gamma GOF Test</b>                                                                                                                                                                                                |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 988  | A-D Test Statistic                                                                                                                                                                                                   |   |   | 0.637                         |        | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |                              |   |        |  |
| 989  | 5% A-D Critical Value                                                                                                                                                                                                |   |   | 0.679                         |        | Detected data appear Gamma Distributed at 5% Significance Level |   |   |                              |   |        |  |
| 990  | K-S Test Statistic                                                                                                                                                                                                   |   |   | 0.331                         |        | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |                              |   |        |  |
| 991  | 5% K-S Critical Value                                                                                                                                                                                                |   |   | 0.357                         |        | Detected data appear Gamma Distributed at 5% Significance Level |   |   |                              |   |        |  |
| 992  | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                                                                                               |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 993  |                                                                                                                                                                                                                      |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 994  | <b>Gamma Statistics</b>                                                                                                                                                                                              |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 995  | k hat (MLE)                                                                                                                                                                                                          |   |   | 16.97                         |        | k star (bias corrected MLE)                                     |   |   | 6.92                         |   |        |  |
| 996  | Theta hat (MLE)                                                                                                                                                                                                      |   |   | 0.0584                        |        | Theta star (bias corrected MLE)                                 |   |   | 0.143                        |   |        |  |
| 997  | nu hat (MLE)                                                                                                                                                                                                         |   |   | 169.7                         |        | nu star (bias corrected)                                        |   |   | 69.2                         |   |        |  |
| 998  | MLE Mean (bias corrected)                                                                                                                                                                                            |   |   | 0.991                         |        | MLE Sd (bias corrected)                                         |   |   | 0.377                        |   |        |  |
| 999  |                                                                                                                                                                                                                      |   |   |                               |        | Approximate Chi Square Value (0.05)                             |   |   | 51.05                        |   |        |  |
| 1000 | Adjusted Level of Significance                                                                                                                                                                                       |   |   | 0.0086                        |        | Adjusted Chi Square Value                                       |   |   | 44.31                        |   |        |  |
| 1001 |                                                                                                                                                                                                                      |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 1002 | <b>Assuming Gamma Distribution</b>                                                                                                                                                                                   |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 1003 | 95% Approximate Gamma UCL (use when n>=50)                                                                                                                                                                           |   |   | 1.343                         |        | 95% Adjusted Gamma UCL (use when n<50)                          |   |   | 1.547                        |   |        |  |
| 1004 |                                                                                                                                                                                                                      |   |   |                               |        |                                                                 |   |   |                              |   |        |  |
| 1005 | <b>Lognormal GOF Test</b>                                                                                                                                                                                            |   |   |                               |        |                                                                 |   |   |                              |   |        |  |

| A    | B                                                                                                                                        | C | D | E      | F                                              | G | H | I       | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|------------------------------------------------|---|---|---------|---|---|---|
| 1006 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.792  | <b>Shapiro Wilk Lognormal GOF Test</b>         |   |   |         |   |   |   |
| 1007 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.762  | Data appear Lognormal at 5% Significance Level |   |   |         |   |   |   |
| 1008 | Lilliefors Test Statistic                                                                                                                |   |   | 0.309  | <b>Lilliefors Lognormal GOF Test</b>           |   |   |         |   |   |   |
| 1009 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.343  | Data appear Lognormal at 5% Significance Level |   |   |         |   |   |   |
| 1010 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |        |                                                |   |   |         |   |   |   |
| 1011 |                                                                                                                                          |   |   |        |                                                |   |   |         |   |   |   |
| 1012 | <b>Lognormal Statistics</b>                                                                                                              |   |   |        |                                                |   |   |         |   |   |   |
| 1013 | Minimum of Logged Data                                                                                                                   |   |   | -0.222 | Mean of logged Data                            |   |   | -0.0393 |   |   |   |
| 1014 | Maximum of Logged Data                                                                                                                   |   |   | 0.392  | SD of logged Data                              |   |   | 0.263   |   |   |   |
| 1015 |                                                                                                                                          |   |   |        |                                                |   |   |         |   |   |   |
| 1016 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |        |                                                |   |   |         |   |   |   |
| 1017 | 95% H-UCL                                                                                                                                |   |   | 1.351  | 90% Chebyshev (MVUE) UCL                       |   |   | 1.336   |   |   |   |
| 1018 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 1.494  | 97.5% Chebyshev (MVUE) UCL                     |   |   | 1.713   |   |   |   |
| 1019 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 2.142  |                                                |   |   |         |   |   |   |
| 1020 |                                                                                                                                          |   |   |        |                                                |   |   |         |   |   |   |
| 1021 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |                                                |   |   |         |   |   |   |
| 1022 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |        |                                                |   |   |         |   |   |   |
| 1023 |                                                                                                                                          |   |   |        |                                                |   |   |         |   |   |   |
| 1024 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |        |                                                |   |   |         |   |   |   |
| 1025 | 95% CLT UCL                                                                                                                              |   |   | 1.204  | 95% Jackknife UCL                              |   |   | 1.267   |   |   |   |
| 1026 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 1.176  | 95% Bootstrap-t UCL                            |   |   | 4.287   |   |   |   |
| 1027 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 3.832  | 95% Percentile Bootstrap UCL                   |   |   | 1.209   |   |   |   |
| 1028 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 1.256  |                                                |   |   |         |   |   |   |
| 1029 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 1.38   | 95% Chebyshev(Mean, Sd) UCL                    |   |   | 1.556   |   |   |   |
| 1030 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 1.801  | 99% Chebyshev(Mean, Sd) UCL                    |   |   | 2.281   |   |   |   |
| 1031 |                                                                                                                                          |   |   |        |                                                |   |   |         |   |   |   |
| 1032 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                |   |   |         |   |   |   |
| 1033 | 95% Student's-t UCL                                                                                                                      |   |   | 1.267  |                                                |   |   |         |   |   |   |
| 1034 |                                                                                                                                          |   |   |        |                                                |   |   |         |   |   |   |
| 1035 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                           |   |   |        |                                                |   |   |         |   |   |   |
| 1036 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                   |   |   |        |                                                |   |   |         |   |   |   |
| 1037 |                                                                                                                                          |   |   |        |                                                |   |   |         |   |   |   |
| 1038 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                |   |   |         |   |   |   |
| 1039 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                |   |   |         |   |   |   |
| 1040 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                |   |   |         |   |   |   |
| 1041 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                |   |   |         |   |   |   |
| 1042 |                                                                                                                                          |   |   |        |                                                |   |   |         |   |   |   |
| 1043 |                                                                                                                                          |   |   |        |                                                |   |   |         |   |   |   |
| 1044 | <b>Result (eu9_copper)</b>                                                                                                               |   |   |        |                                                |   |   |         |   |   |   |
| 1045 |                                                                                                                                          |   |   |        |                                                |   |   |         |   |   |   |
| 1046 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                |   |   |         |   |   |   |
| 1047 | Total Number of Observations                                                                                                             |   |   | 5      | Number of Distinct Observations                |   |   | 5       |   |   |   |
| 1048 |                                                                                                                                          |   |   |        | Number of Missing Observations                 |   |   | 0       |   |   |   |
| 1049 | Minimum                                                                                                                                  |   |   | 0.364  | Mean                                           |   |   | 0.47    |   |   |   |
| 1050 | Maximum                                                                                                                                  |   |   | 0.672  | Median                                         |   |   | 0.439   |   |   |   |
| 1051 | SD                                                                                                                                       |   |   | 0.119  | Std. Error of Mean                             |   |   | 0.0533  |   |   |   |
| 1052 | Coefficient of Variation                                                                                                                 |   |   | 0.253  | Skewness                                       |   |   | 1.676   |   |   |   |
| 1053 |                                                                                                                                          |   |   |        |                                                |   |   |         |   |   |   |
| 1054 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |   |   |        |                                                |   |   |         |   |   |   |
| 1055 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |   |   |        |                                                |   |   |         |   |   |   |
| 1056 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |   |   |        |                                                |   |   |         |   |   |   |
| 1057 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |   |   |        |                                                |   |   |         |   |   |   |
| 1058 |                                                                                                                                          |   |   |        |                                                |   |   |         |   |   |   |
| 1059 | <b>Normal GOF Test</b>                                                                                                                   |   |   |        |                                                |   |   |         |   |   |   |
| 1060 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.841  | <b>Shapiro Wilk GOF Test</b>                   |   |   |         |   |   |   |
| 1061 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.762  | Data appear Normal at 5% Significance Level    |   |   |         |   |   |   |
| 1062 | Lilliefors Test Statistic                                                                                                                |   |   | 0.313  | <b>Lilliefors GOF Test</b>                     |   |   |         |   |   |   |
| 1063 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.343  | Data appear Normal at 5% Significance Level    |   |   |         |   |   |   |
| 1064 | <b>Data appear Normal at 5% Significance Level</b>                                                                                       |   |   |        |                                                |   |   |         |   |   |   |
| 1065 |                                                                                                                                          |   |   |        |                                                |   |   |         |   |   |   |
| 1066 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |        |                                                |   |   |         |   |   |   |
| 1067 | <b>95% Normal UCL</b>                                                                                                                    |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>        |   |   |         |   |   |   |
| 1068 | 95% Student's-t UCL                                                                                                                      |   |   | 0.583  | 95% Adjusted-CLT UCL (Chen-1995)               |   |   | 0.6     |   |   |   |
| 1069 |                                                                                                                                          |   |   |        | 95% Modified-t UCL (Johnson-1978)              |   |   | 0.59    |   |   |   |
| 1070 |                                                                                                                                          |   |   |        |                                                |   |   |         |   |   |   |
| 1071 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |        |                                                |   |   |         |   |   |   |
| 1072 | A-D Test Statistic                                                                                                                       |   |   | 0.428  | <b>Anderson-Darling Gamma GOF Test</b>         |   |   |         |   |   |   |

| A    | B                                                                                                                                        | C | D                                           | E      | F                                                               | G | H | I | J                                      | K      | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---------------------------------------------|--------|-----------------------------------------------------------------|---|---|---|----------------------------------------|--------|---|
| 1073 |                                                                                                                                          |   | 5% A-D Critical Value                       | 0.679  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |                                        |        |   |
| 1074 |                                                                                                                                          |   | K-S Test Statistic                          | 0.287  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |   |                                        |        |   |
| 1075 |                                                                                                                                          |   | 5% K-S Critical Value                       | 0.357  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |                                        |        |   |
| 1076 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1077 |                                                                                                                                          |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1078 | <b>Gamma Statistics</b>                                                                                                                  |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1079 |                                                                                                                                          |   | k hat (MLE)                                 | 22.12  |                                                                 |   |   |   | k star (bias corrected MLE)            | 8.983  |   |
| 1080 |                                                                                                                                          |   | Theta hat (MLE)                             | 0.0212 |                                                                 |   |   |   | Theta star (bias corrected MLE)        | 0.0523 |   |
| 1081 |                                                                                                                                          |   | nu hat (MLE)                                | 221.2  |                                                                 |   |   |   | nu star (bias corrected)               | 89.83  |   |
| 1082 |                                                                                                                                          |   | MLE Mean (bias corrected)                   | 0.47   |                                                                 |   |   |   | MLE Sd (bias corrected)                | 0.157  |   |
| 1083 |                                                                                                                                          |   |                                             |        |                                                                 |   |   |   | Approximate Chi Square Value (0.05)    | 68.97  |   |
| 1084 |                                                                                                                                          |   | Adjusted Level of Significance              | 0.0086 |                                                                 |   |   |   | Adjusted Chi Square Value              | 61.03  |   |
| 1085 |                                                                                                                                          |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1086 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1087 |                                                                                                                                          |   | 95% Approximate Gamma UCL (use when n>=50)) | 0.612  |                                                                 |   |   |   | 95% Adjusted Gamma UCL (use when n<50) | 0.692  |   |
| 1088 |                                                                                                                                          |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1089 | <b>Lognormal GOF Test</b>                                                                                                                |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1090 |                                                                                                                                          |   | Shapiro Wilk Test Statistic                 | 0.898  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |   |                                        |        |   |
| 1091 |                                                                                                                                          |   | 5% Shapiro Wilk Critical Value              | 0.762  | Data appear Lognormal at 5% Significance Level                  |   |   |   |                                        |        |   |
| 1092 |                                                                                                                                          |   | Lilliefors Test Statistic                   | 0.275  | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |   |                                        |        |   |
| 1093 |                                                                                                                                          |   | 5% Lilliefors Critical Value                | 0.343  | Data appear Lognormal at 5% Significance Level                  |   |   |   |                                        |        |   |
| 1094 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1095 |                                                                                                                                          |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1096 | <b>Lognormal Statistics</b>                                                                                                              |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1097 |                                                                                                                                          |   | Minimum of Logged Data                      | -1.011 |                                                                 |   |   |   | Mean of logged Data                    | -0.778 |   |
| 1098 |                                                                                                                                          |   | Maximum of Logged Data                      | -0.398 |                                                                 |   |   |   | SD of logged Data                      | 0.232  |   |
| 1099 |                                                                                                                                          |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1100 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1101 |                                                                                                                                          |   | 95% H-UCL                                   | 0.613  |                                                                 |   |   |   | 90% Chebyshev (MVUE) UCL               | 0.615  |   |
| 1102 |                                                                                                                                          |   | 95% Chebyshev (MVUE) UCL                    | 0.681  |                                                                 |   |   |   | 97.5% Chebyshev (MVUE) UCL             | 0.772  |   |
| 1103 |                                                                                                                                          |   | 99% Chebyshev (MVUE) UCL                    | 0.952  |                                                                 |   |   |   |                                        |        |   |
| 1104 |                                                                                                                                          |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1105 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1106 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1107 |                                                                                                                                          |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1108 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1109 |                                                                                                                                          |   | 95% CLT UCL                                 | 0.557  |                                                                 |   |   |   | 95% Jackknife UCL                      | 0.583  |   |
| 1110 |                                                                                                                                          |   | 95% Standard Bootstrap UCL                  | 0.548  |                                                                 |   |   |   | 95% Bootstrap-t UCL                    | 0.695  |   |
| 1111 |                                                                                                                                          |   | 95% Hall's Bootstrap UCL                    | 0.978  |                                                                 |   |   |   | 95% Percentile Bootstrap UCL           | 0.564  |   |
| 1112 |                                                                                                                                          |   | 95% BCA Bootstrap UCL                       | 0.573  |                                                                 |   |   |   |                                        |        |   |
| 1113 |                                                                                                                                          |   | 90% Chebyshev(Mean, Sd) UCL                 | 0.63   |                                                                 |   |   |   | 95% Chebyshev(Mean, Sd) UCL            | 0.702  |   |
| 1114 |                                                                                                                                          |   | 97.5% Chebyshev(Mean, Sd) UCL               | 0.802  |                                                                 |   |   |   | 99% Chebyshev(Mean, Sd) UCL            | 1      |   |
| 1115 |                                                                                                                                          |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1116 | <b>Suggested UCL to Use</b>                                                                                                              |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1117 |                                                                                                                                          |   | 95% Student's-t UCL                         | 0.583  |                                                                 |   |   |   |                                        |        |   |
| 1118 |                                                                                                                                          |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1119 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1120 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1121 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1122 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1123 |                                                                                                                                          |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1124 | <b>Result (eu9_iron)</b>                                                                                                                 |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1125 |                                                                                                                                          |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1126 | <b>General Statistics</b>                                                                                                                |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1127 |                                                                                                                                          |   | Total Number of Observations                | 5      |                                                                 |   |   |   | Number of Distinct Observations        | 5      |   |
| 1128 |                                                                                                                                          |   | Number of Detects                           | 0      |                                                                 |   |   |   | Number of Non-Detects                  | 5      |   |
| 1129 |                                                                                                                                          |   | Number of Distinct Detects                  | 0      |                                                                 |   |   |   | Number of Distinct Non-Detects         | 5      |   |
| 1130 |                                                                                                                                          |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1131 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                       |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1132 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>                 |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1133 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>        |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1134 |                                                                                                                                          |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1135 | <b>The data set for variable Result (eu9_iron) was not processed!</b>                                                                    |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1136 |                                                                                                                                          |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1137 |                                                                                                                                          |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1138 | <b>Result (eu9_lead)</b>                                                                                                                 |   |                                             |        |                                                                 |   |   |   |                                        |        |   |
| 1139 |                                                                                                                                          |   |                                             |        |                                                                 |   |   |   |                                        |        |   |

|      | A                                                                                                                         | B | C         | D                                           | E                                                             | F                                                 | G | H       | I | J      | K | L |  |
|------|---------------------------------------------------------------------------------------------------------------------------|---|-----------|---------------------------------------------|---------------------------------------------------------------|---------------------------------------------------|---|---------|---|--------|---|---|--|
| 1140 | <b>General Statistics</b>                                                                                                 |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1141 | Total Number of Observations                                                                                              |   |           |                                             | 5                                                             | Number of Distinct Observations                   |   |         |   | 5      |   |   |  |
| 1142 | Number of Detects                                                                                                         |   |           |                                             | 4                                                             | Number of Non-Detects                             |   |         |   | 1      |   |   |  |
| 1143 | Number of Distinct Detects                                                                                                |   |           |                                             | 4                                                             | Number of Distinct Non-Detects                    |   |         |   | 1      |   |   |  |
| 1144 | Minimum Detect                                                                                                            |   |           |                                             | 0.0119                                                        | Minimum Non-Detect                                |   |         |   | 0.0101 |   |   |  |
| 1145 | Maximum Detect                                                                                                            |   |           |                                             | 0.0609                                                        | Maximum Non-Detect                                |   |         |   | 0.0101 |   |   |  |
| 1146 | Variance Detects                                                                                                          |   |           |                                             | 5.3731E-4                                                     | Percent Non-Detects                               |   |         |   | 20%    |   |   |  |
| 1147 | Mean Detects                                                                                                              |   |           |                                             | 0.0264                                                        | SD Detects                                        |   |         |   | 0.0232 |   |   |  |
| 1148 | Median Detects                                                                                                            |   |           |                                             | 0.0164                                                        | CV Detects                                        |   |         |   | 0.878  |   |   |  |
| 1149 | Skewness Detects                                                                                                          |   |           |                                             | 1.918                                                         | Kurtosis Detects                                  |   |         |   | 3.717  |   |   |  |
| 1150 | Mean of Logged Detects                                                                                                    |   |           |                                             | -3.867                                                        | SD of Logged Detects                              |   |         |   | 0.735  |   |   |  |
| 1151 |                                                                                                                           |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1152 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1153 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                    |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1154 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                       |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1155 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                            |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1156 |                                                                                                                           |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1157 | <b>Normal GOF Test on Detects Only</b>                                                                                    |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1158 | Shapiro Wilk Test Statistic                                                                                               |   |           |                                             | 0.735                                                         | <b>Shapiro Wilk GOF Test</b>                      |   |         |   |        |   |   |  |
| 1159 | 5% Shapiro Wilk Critical Value                                                                                            |   |           |                                             | 0.748                                                         | Detected Data Not Normal at 5% Significance Level |   |         |   |        |   |   |  |
| 1160 | Lilliefors Test Statistic                                                                                                 |   |           |                                             | 0.384                                                         | <b>Lilliefors GOF Test</b>                        |   |         |   |        |   |   |  |
| 1161 | 5% Lilliefors Critical Value                                                                                              |   |           |                                             | 0.375                                                         | Detected Data Not Normal at 5% Significance Level |   |         |   |        |   |   |  |
| 1162 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                  |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1163 |                                                                                                                           |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1164 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1165 | KM Mean                                                                                                                   |   |           | 0.0231                                      | KM Standard Error of Mean                                     |                                                   |   | 0.00987 |   |        |   |   |  |
| 1166 | KM SD                                                                                                                     |   |           | 0.0191                                      | 95% KM (BCA) UCL                                              |                                                   |   | N/A     |   |        |   |   |  |
| 1167 | 95% KM (t) UCL                                                                                                            |   |           | 0.0442                                      | 95% KM (Percentile Bootstrap) UCL                             |                                                   |   | N/A     |   |        |   |   |  |
| 1168 | 95% KM (z) UCL                                                                                                            |   |           | 0.0394                                      | 95% KM Bootstrap t UCL                                        |                                                   |   | N/A     |   |        |   |   |  |
| 1169 | 90% KM Chebyshev UCL                                                                                                      |   |           | 0.0527                                      | 95% KM Chebyshev UCL                                          |                                                   |   | 0.0661  |   |        |   |   |  |
| 1170 | 97.5% KM Chebyshev UCL                                                                                                    |   |           | 0.0847                                      | 99% KM Chebyshev UCL                                          |                                                   |   | 0.121   |   |        |   |   |  |
| 1171 |                                                                                                                           |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1172 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1173 | A-D Test Statistic                                                                                                        |   |           | 0.569                                       | <b>Anderson-Darling GOF Test</b>                              |                                                   |   |         |   |        |   |   |  |
| 1174 | 5% A-D Critical Value                                                                                                     |   |           | 0.66                                        | Detected data appear Gamma Distributed at 5% Significance Lev |                                                   |   |         |   |        |   |   |  |
| 1175 | K-S Test Statistic                                                                                                        |   |           | 0.362                                       | <b>Kolmogorov-Smirnov GOF</b>                                 |                                                   |   |         |   |        |   |   |  |
| 1176 | 5% K-S Critical Value                                                                                                     |   |           | 0.397                                       | Detected data appear Gamma Distributed at 5% Significance Lev |                                                   |   |         |   |        |   |   |  |
| 1177 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                    |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1178 |                                                                                                                           |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1179 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1180 | k hat (MLE)                                                                                                               |   | 2.301     | k star (bias corrected MLE)                 |                                                               | 0.742                                             |   |         |   |        |   |   |  |
| 1181 | Theta hat (MLE)                                                                                                           |   | 0.0115    | Theta star (bias corrected MLE)             |                                                               | 0.0356                                            |   |         |   |        |   |   |  |
| 1182 | nu hat (MLE)                                                                                                              |   | 18.4      | nu star (bias corrected)                    |                                                               | 5.934                                             |   |         |   |        |   |   |  |
| 1183 | Mean (detects)                                                                                                            |   | 0.0264    |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1184 |                                                                                                                           |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1185 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1186 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1187 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1188 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1189 | This is especially true when the sample size is small.                                                                    |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1190 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1191 | Minimum                                                                                                                   |   | 0.01      | Mean                                        |                                                               | 0.0231                                            |   |         |   |        |   |   |  |
| 1192 | Maximum                                                                                                                   |   | 0.0609    | Median                                      |                                                               | 0.0143                                            |   |         |   |        |   |   |  |
| 1193 | SD                                                                                                                        |   | 0.0214    | CV                                          |                                                               | 0.924                                             |   |         |   |        |   |   |  |
| 1194 | k hat (MLE)                                                                                                               |   | 2.17      | k star (bias corrected MLE)                 |                                                               | 1.001                                             |   |         |   |        |   |   |  |
| 1195 | Theta hat (MLE)                                                                                                           |   | 0.0107    | Theta star (bias corrected MLE)             |                                                               | 0.0231                                            |   |         |   |        |   |   |  |
| 1196 | nu hat (MLE)                                                                                                              |   | 21.7      | nu star (bias corrected)                    |                                                               | 10.01                                             |   |         |   |        |   |   |  |
| 1197 | Adjusted Level of Significance ( $\beta$ )                                                                                |   | 0.0086    |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1198 | Approximate Chi Square Value (10.01, $\alpha$ )                                                                           |   | 3.951     | Adjusted Chi Square Value (10.01, $\beta$ ) |                                                               | 2.474                                             |   |         |   |        |   |   |  |
| 1199 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   | 0.0586    | 95% Gamma Adjusted UCL (use when $n < 50$ ) |                                                               | N/A                                               |   |         |   |        |   |   |  |
| 1200 |                                                                                                                           |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1201 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |           |                                             |                                                               |                                                   |   |         |   |        |   |   |  |
| 1202 | Mean (KM)                                                                                                                 |   | 0.0231    | SD (KM)                                     |                                                               | 0.0191                                            |   |         |   |        |   |   |  |
| 1203 | Variance (KM)                                                                                                             |   | 3.6500E-4 | SE of Mean (KM)                             |                                                               | 0.00987                                           |   |         |   |        |   |   |  |
| 1204 | k hat (KM)                                                                                                                |   | 1.467     | k star (KM)                                 |                                                               | 0.72                                              |   |         |   |        |   |   |  |
| 1205 | nu hat (KM)                                                                                                               |   | 14.67     | nu star (KM)                                |                                                               | 7.2                                               |   |         |   |        |   |   |  |
| 1206 | theta hat (KM)                                                                                                            |   | 0.0158    | theta star (KM)                             |                                                               | 0.0321                                            |   |         |   |        |   |   |  |

| A    | B                                                                                                                                        | C                                                | D | E      | F | G                           | H | I                                                                | J | K | L      |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|---|--------|---|-----------------------------|---|------------------------------------------------------------------|---|---|--------|
| 1207 |                                                                                                                                          | 80% gamma percentile (KM)                        |   | 0.038  |   |                             |   | 90% gamma percentile (KM)                                        |   |   | 0.0577 |
| 1208 |                                                                                                                                          | 95% gamma percentile (KM)                        |   | 0.078  |   |                             |   | 99% gamma percentile (KM)                                        |   |   | 0.126  |
| 1209 |                                                                                                                                          |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1210 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1211 |                                                                                                                                          | Approximate Chi Square Value (7.20, $\alpha$ )   |   | 2.281  |   |                             |   | Adjusted Chi Square Value (7.20, $\beta$ )                       |   |   | 1.263  |
| 1212 | 5%                                                                                                                                       | Gamma Approximate KM-UCL (use when $n \geq 50$ ) |   | 0.073  |   |                             |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )                   |   |   | 0.132  |
| 1213 |                                                                                                                                          |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1214 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1215 |                                                                                                                                          | Shapiro Wilk Test Statistic                      |   | 0.839  |   |                             |   | <b>Shapiro Wilk GOF Test</b>                                     |   |   |        |
| 1216 |                                                                                                                                          | 5% Shapiro Wilk Critical Value                   |   | 0.748  |   |                             |   | Detected Data appear Lognormal at 5% Significance Level          |   |   |        |
| 1217 |                                                                                                                                          | Lilliefors Test Statistic                        |   | 0.317  |   |                             |   | <b>Lilliefors GOF Test</b>                                       |   |   |        |
| 1218 |                                                                                                                                          | 5% Lilliefors Critical Value                     |   | 0.375  |   |                             |   | Detected Data appear Lognormal at 5% Significance Level          |   |   |        |
| 1219 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                           |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1220 |                                                                                                                                          |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1221 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1222 |                                                                                                                                          | Mean in Original Scale                           |   | 0.0218 |   |                             |   | Mean in Log Scale                                                |   |   | -4.238 |
| 1223 |                                                                                                                                          | SD in Original Scale                             |   | 0.0226 |   |                             |   | SD in Log Scale                                                  |   |   | 1.046  |
| 1224 |                                                                                                                                          | 95% t UCL (assumes normality of ROS data)        |   | 0.0433 |   |                             |   | 95% Percentile Bootstrap UCL                                     |   |   | 0.0396 |
| 1225 |                                                                                                                                          | 95% BCA Bootstrap UCL                            |   | 0.0426 |   |                             |   | 95% Bootstrap t UCL                                              |   |   | 0.0808 |
| 1226 |                                                                                                                                          | 95% H-UCL (Log ROS)                              |   | 0.361  |   |                             |   |                                                                  |   |   |        |
| 1227 |                                                                                                                                          |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1228 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1229 |                                                                                                                                          | KM Mean (logged)                                 |   | -4.013 |   |                             |   | KM Geo Mean                                                      |   |   | 0.0181 |
| 1230 |                                                                                                                                          | KM SD (logged)                                   |   | 0.64   |   |                             |   | 95% Critical H Value (KM-Log)                                    |   |   | 3.433  |
| 1231 |                                                                                                                                          | KM Standard Error of Mean (logged)               |   | 0.331  |   |                             |   | 95% H-UCL (KM -Log)                                              |   |   | 0.0666 |
| 1232 |                                                                                                                                          | KM SD (logged)                                   |   | 0.64   |   |                             |   | 95% Critical H Value (KM-Log)                                    |   |   | 3.433  |
| 1233 |                                                                                                                                          | KM Standard Error of Mean (logged)               |   | 0.331  |   |                             |   |                                                                  |   |   |        |
| 1234 |                                                                                                                                          |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1235 | <b>DL/2 Statistics</b>                                                                                                                   |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1236 | <b>DL/2 Normal</b>                                                                                                                       |                                                  |   |        |   | <b>DL/2 Log-Transformed</b> |   |                                                                  |   |   |        |
| 1237 |                                                                                                                                          | Mean in Original Scale                           |   | 0.0221 |   |                             |   | Mean in Log Scale                                                |   |   | -4.152 |
| 1238 |                                                                                                                                          | SD in Original Scale                             |   | 0.0222 |   |                             |   | SD in Log Scale                                                  |   |   | 0.9    |
| 1239 |                                                                                                                                          | 95% t UCL (Assumes normality)                    |   | 0.0433 |   |                             |   | 95% H-Stat UCL                                                   |   |   | 0.177  |
| 1240 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1241 |                                                                                                                                          |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1242 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1243 | <b>Detected Data appear Gamma Distributed at 5% Significance Level</b>                                                                   |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1244 |                                                                                                                                          |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1245 | <b>Suggested UCL to Use</b>                                                                                                              |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1246 |                                                                                                                                          | 95% KM Bootstrap t UCL                           |   | N/A    |   |                             |   | d KM-UCL (use when $k \leq 1$ and $15 < n < 50$ but $k \leq 1$ ) |   |   | 0.132  |
| 1247 |                                                                                                                                          |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1248 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1249 | Recommendations are based upon data size, data distribution, and skewness.                                                               |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1250 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1251 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1252 |                                                                                                                                          |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1253 | <b>Result (eu9_manganese)</b>                                                                                                            |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1254 |                                                                                                                                          |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1255 | <b>General Statistics</b>                                                                                                                |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1256 |                                                                                                                                          | Total Number of Observations                     |   | 5      |   |                             |   | Number of Distinct Observations                                  |   |   | 5      |
| 1257 |                                                                                                                                          | Number of Detects                                |   | 3      |   |                             |   | Number of Non-Detects                                            |   |   | 2      |
| 1258 |                                                                                                                                          | Number of Distinct Detects                       |   | 3      |   |                             |   | Number of Distinct Non-Detects                                   |   |   | 2      |
| 1259 |                                                                                                                                          | Minimum Detect                                   |   | 0.182  |   |                             |   | Minimum Non-Detect                                               |   |   | 0.2    |
| 1260 |                                                                                                                                          | Maximum Detect                                   |   | 0.42   |   |                             |   | Maximum Non-Detect                                               |   |   | 0.207  |
| 1261 |                                                                                                                                          | Variance Detects                                 |   | 0.0142 |   |                             |   | Percent Non-Detects                                              |   |   | 40%    |
| 1262 |                                                                                                                                          | Mean Detects                                     |   | 0.298  |   |                             |   | SD Detects                                                       |   |   | 0.119  |
| 1263 |                                                                                                                                          | Median Detects                                   |   | 0.291  |   |                             |   | CV Detects                                                       |   |   | 0.4    |
| 1264 |                                                                                                                                          | Skewness Detects                                 |   | 0.248  |   |                             |   | Kurtosis Detects                                                 |   |   | N/A    |
| 1265 |                                                                                                                                          | Mean of Logged Detects                           |   | -1.268 |   |                             |   | SD of Logged Detects                                             |   |   | 0.419  |
| 1266 |                                                                                                                                          |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1267 | <b>Warning: Data set has only 3 Detected Values.</b>                                                                                     |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1268 | <b>This is not enough to compute meaningful or reliable statistics and estimates.</b>                                                    |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1269 |                                                                                                                                          |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1270 |                                                                                                                                          |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1271 | <b>Note: Sample size is small (e.g., <math>&lt; 10</math>), if data are collected using ISM approach, you should use</b>                 |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1272 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |                                                  |   |        |   |                             |   |                                                                  |   |   |        |
| 1273 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |                                                  |   |        |   |                             |   |                                                                  |   |   |        |

|      | A                                                                                                                         | B | C | D       | E | F                                                       | G | H | I      | J | K | L |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|---------|---|---------------------------------------------------------|---|---|--------|---|---|---|
| 1274 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                            |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1275 |                                                                                                                           |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1276 | <b>Normal GOF Test on Detects Only</b>                                                                                    |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1277 | Shapiro Wilk Test Statistic                                                                                               |   |   | 0.998   |   | <b>Shapiro Wilk GOF Test</b>                            |   |   |        |   |   |   |
| 1278 | 5% Shapiro Wilk Critical Value                                                                                            |   |   | 0.767   |   | Detected Data appear Normal at 5% Significance Level    |   |   |        |   |   |   |
| 1279 | Lilliefors Test Statistic                                                                                                 |   |   | 0.189   |   | <b>Lilliefors GOF Test</b>                              |   |   |        |   |   |   |
| 1280 | 5% Lilliefors Critical Value                                                                                              |   |   | 0.425   |   | Detected Data appear Normal at 5% Significance Level    |   |   |        |   |   |   |
| 1281 | <b>Detected Data appear Normal at 5% Significance Level</b>                                                               |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1282 |                                                                                                                           |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1283 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1284 | KM Mean                                                                                                                   |   |   | 0.251   |   | KM Standard Error of Mean                               |   |   | 0.0517 |   |   |   |
| 1285 | KM SD                                                                                                                     |   |   | 0.0944  |   | 95% KM (BCA) UCL                                        |   |   | N/A    |   |   |   |
| 1286 | 95% KM (t) UCL                                                                                                            |   |   | 0.362   |   | 95% KM (Percentile Bootstrap) UCL                       |   |   | N/A    |   |   |   |
| 1287 | 95% KM (z) UCL                                                                                                            |   |   | 0.336   |   | 95% KM Bootstrap t UCL                                  |   |   | N/A    |   |   |   |
| 1288 | 90% KM Chebyshev UCL                                                                                                      |   |   | 0.407   |   | 95% KM Chebyshev UCL                                    |   |   | 0.477  |   |   |   |
| 1289 | 97.5% KM Chebyshev UCL                                                                                                    |   |   | 0.574   |   | 99% KM Chebyshev UCL                                    |   |   | 0.766  |   |   |   |
| 1290 |                                                                                                                           |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1291 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1292 | <b>Not Enough Data to Perform GOF Test</b>                                                                                |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1293 |                                                                                                                           |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1294 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1295 | k hat (MLE)                                                                                                               |   |   | 8.96    |   | k star (bias corrected MLE)                             |   |   | N/A    |   |   |   |
| 1296 | Theta hat (MLE)                                                                                                           |   |   | 0.0332  |   | Theta star (bias corrected MLE)                         |   |   | N/A    |   |   |   |
| 1297 | nu hat (MLE)                                                                                                              |   |   | 53.76   |   | nu star (bias corrected)                                |   |   | N/A    |   |   |   |
| 1298 | Mean (detects)                                                                                                            |   |   | 0.298   |   |                                                         |   |   |        |   |   |   |
| 1299 |                                                                                                                           |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1300 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1301 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1302 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1303 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1304 | This is especially true when the sample size is small.                                                                    |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1305 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1306 | Minimum                                                                                                                   |   |   | 0.171   |   | Mean                                                    |   |   | 0.247  |   |   |   |
| 1307 | Maximum                                                                                                                   |   |   | 0.42    |   | Median                                                  |   |   | 0.182  |   |   |   |
| 1308 | SD                                                                                                                        |   |   | 0.109   |   | CV                                                      |   |   | 0.441  |   |   |   |
| 1309 | k hat (MLE)                                                                                                               |   |   | 7.409   |   | k star (bias corrected MLE)                             |   |   | 3.097  |   |   |   |
| 1310 | Theta hat (MLE)                                                                                                           |   |   | 0.0334  |   | Theta star (bias corrected MLE)                         |   |   | 0.0798 |   |   |   |
| 1311 | nu hat (MLE)                                                                                                              |   |   | 74.09   |   | nu star (bias corrected)                                |   |   | 30.97  |   |   |   |
| 1312 | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   | 0.0086  |   |                                                         |   |   |        |   |   |   |
| 1313 | Approximate Chi Square Value (30.97, $\alpha$ )                                                                           |   |   | 19.26   |   | Adjusted Chi Square Value (30.97, $\beta$ )             |   |   | 15.36  |   |   |   |
| 1314 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   | 0.398   |   | 95% Gamma Adjusted UCL (use when $n < 50$ )             |   |   | N/A    |   |   |   |
| 1315 |                                                                                                                           |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1316 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1317 | Mean (KM)                                                                                                                 |   |   | 0.251   |   | SD (KM)                                                 |   |   | 0.0944 |   |   |   |
| 1318 | Variance (KM)                                                                                                             |   |   | 0.00891 |   | SE of Mean (KM)                                         |   |   | 0.0517 |   |   |   |
| 1319 | k hat (KM)                                                                                                                |   |   | 7.102   |   | k star (KM)                                             |   |   | 2.974  |   |   |   |
| 1320 | nu hat (KM)                                                                                                               |   |   | 71.02   |   | nu star (KM)                                            |   |   | 29.74  |   |   |   |
| 1321 | theta hat (KM)                                                                                                            |   |   | 0.0354  |   | theta star (KM)                                         |   |   | 0.0846 |   |   |   |
| 1322 | 80% gamma percentile (KM)                                                                                                 |   |   | 0.359   |   | 90% gamma percentile (KM)                               |   |   | 0.447  |   |   |   |
| 1323 | 95% gamma percentile (KM)                                                                                                 |   |   | 0.529   |   | 99% gamma percentile (KM)                               |   |   | 0.707  |   |   |   |
| 1324 |                                                                                                                           |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1325 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1326 | Approximate Chi Square Value (29.74, $\alpha$ )                                                                           |   |   | 18.29   |   | Adjusted Chi Square Value (29.74, $\beta$ )             |   |   | 14.51  |   |   |   |
| 1327 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   |   | 0.409   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )          |   |   | 0.516  |   |   |   |
| 1328 |                                                                                                                           |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1329 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1330 | Shapiro Wilk Test Statistic                                                                                               |   |   | 0.995   |   | <b>Shapiro Wilk GOF Test</b>                            |   |   |        |   |   |   |
| 1331 | 5% Shapiro Wilk Critical Value                                                                                            |   |   | 0.767   |   | Detected Data appear Lognormal at 5% Significance Level |   |   |        |   |   |   |
| 1332 | Lilliefors Test Statistic                                                                                                 |   |   | 0.199   |   | <b>Lilliefors GOF Test</b>                              |   |   |        |   |   |   |
| 1333 | 5% Lilliefors Critical Value                                                                                              |   |   | 0.425   |   | Detected Data appear Lognormal at 5% Significance Level |   |   |        |   |   |   |
| 1334 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                            |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1335 |                                                                                                                           |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1336 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |   |   |         |   |                                                         |   |   |        |   |   |   |
| 1337 | Mean in Original Scale                                                                                                    |   |   | 0.25    |   | Mean in Log Scale                                       |   |   | -1.451 |   |   |   |
| 1338 | SD in Original Scale                                                                                                      |   |   | 0.107   |   | SD in Log Scale                                         |   |   | 0.388  |   |   |   |
| 1339 | 95% t UCL (assumes normality of ROS data)                                                                                 |   |   | 0.352   |   | 95% Percentile Bootstrap UCL                            |   |   | N/A    |   |   |   |
| 1340 | 95% BCA Bootstrap UCL                                                                                                     |   |   | N/A     |   | 95% Bootstrap t UCL                                     |   |   | N/A    |   |   |   |

| A    | B                                                                                                                                        | C | D | E         | F                                                               | G                                       | H | I       | J | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|-----------|-----------------------------------------------------------------|-----------------------------------------|---|---------|---|---|---|--|
| 1341 | 95% H-UCL (Log ROS)                                                                                                                      |   |   | 0.42      |                                                                 |                                         |   |         |   |   |   |  |
| 1342 |                                                                                                                                          |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1343 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1344 | KM Mean (logged)                                                                                                                         |   |   | -1.442    | KM Geo Mean                                                     |                                         |   | 0.236   |   |   |   |  |
| 1345 | KM SD (logged)                                                                                                                           |   |   | 0.34      | 95% Critical H Value (KM-Log)                                   |                                         |   | 2.497   |   |   |   |  |
| 1346 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.186     | 95% H-UCL (KM -Log)                                             |                                         |   | 0.383   |   |   |   |  |
| 1347 | KM SD (logged)                                                                                                                           |   |   | 0.34      | 95% Critical H Value (KM-Log)                                   |                                         |   | 2.497   |   |   |   |  |
| 1348 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.186     |                                                                 |                                         |   |         |   |   |   |  |
| 1349 |                                                                                                                                          |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1350 | <b>DL/2 Statistics</b>                                                                                                                   |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1351 | <b>DL/2 Normal</b>                                                                                                                       |   |   |           |                                                                 | <b>DL/2 Log-Transformed</b>             |   |         |   |   |   |  |
| 1352 | Mean in Original Scale                                                                                                                   |   |   | 0.219     | Mean in Log Scale                                               |                                         |   | -1.675  |   |   |   |  |
| 1353 | SD in Original Scale                                                                                                                     |   |   | 0.137     | SD in Log Scale                                                 |                                         |   | 0.631   |   |   |   |  |
| 1354 | 95% t UCL (Assumes normality)                                                                                                            |   |   | 0.35      | 95% H-Stat UCL                                                  |                                         |   | 0.669   |   |   |   |  |
| 1355 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1356 |                                                                                                                                          |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1357 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1358 | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                  |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1359 |                                                                                                                                          |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1360 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1361 | 95% KM (t) UCL                                                                                                                           |   |   | 0.362     |                                                                 |                                         |   |         |   |   |   |  |
| 1362 |                                                                                                                                          |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1363 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1364 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1365 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1366 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1367 |                                                                                                                                          |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1368 |                                                                                                                                          |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1369 | <b>Result (eu9_mercury)</b>                                                                                                              |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1370 |                                                                                                                                          |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1371 | <b>General Statistics</b>                                                                                                                |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1372 | Total Number of Observations                                                                                                             |   |   | 5         | Number of Distinct Observations                                 |                                         |   | 5       |   |   |   |  |
| 1373 |                                                                                                                                          |   |   |           | Number of Missing Observations                                  |                                         |   | 0       |   |   |   |  |
| 1374 | Minimum                                                                                                                                  |   |   | 0.0149    | Mean                                                            |                                         |   | 0.021   |   |   |   |  |
| 1375 | Maximum                                                                                                                                  |   |   | 0.0266    | Median                                                          |                                         |   | 0.0214  |   |   |   |  |
| 1376 | SD                                                                                                                                       |   |   | 0.00449   | Std. Error of Mean                                              |                                         |   | 0.00201 |   |   |   |  |
| 1377 | Coefficient of Variation                                                                                                                 |   |   | 0.214     | Skewness                                                        |                                         |   | -0.225  |   |   |   |  |
| 1378 |                                                                                                                                          |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1379 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1380 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1381 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1382 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1383 |                                                                                                                                          |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1384 | <b>Normal GOF Test</b>                                                                                                                   |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1385 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.994     | <b>Shapiro Wilk GOF Test</b>                                    |                                         |   |         |   |   |   |  |
| 1386 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.762     | Data appear Normal at 5% Significance Level                     |                                         |   |         |   |   |   |  |
| 1387 | Lilliefors Test Statistic                                                                                                                |   |   | 0.135     | <b>Lilliefors GOF Test</b>                                      |                                         |   |         |   |   |   |  |
| 1388 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.343     | Data appear Normal at 5% Significance Level                     |                                         |   |         |   |   |   |  |
| 1389 | <b>Data appear Normal at 5% Significance Level</b>                                                                                       |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1390 |                                                                                                                                          |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1391 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1392 | <b>95% Normal UCL</b>                                                                                                                    |   |   |           |                                                                 | <b>95% UCLs (Adjusted for Skewness)</b> |   |         |   |   |   |  |
| 1393 | 95% Student's-t UCL                                                                                                                      |   |   | 0.0253    | 95% Adjusted-CLT UCL (Chen-1995)                                |                                         |   | 0.0241  |   |   |   |  |
| 1394 |                                                                                                                                          |   |   |           | 95% Modified-t UCL (Johnson-1978)                               |                                         |   | 0.0252  |   |   |   |  |
| 1395 |                                                                                                                                          |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1396 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1397 | A-D Test Statistic                                                                                                                       |   |   | 0.185     | <b>Anderson-Darling Gamma GOF Test</b>                          |                                         |   |         |   |   |   |  |
| 1398 | 5% A-D Critical Value                                                                                                                    |   |   | 0.679     | Detected data appear Gamma Distributed at 5% Significance Level |                                         |   |         |   |   |   |  |
| 1399 | K-S Test Statistic                                                                                                                       |   |   | 0.164     | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |                                         |   |         |   |   |   |  |
| 1400 | 5% K-S Critical Value                                                                                                                    |   |   | 0.357     | Detected data appear Gamma Distributed at 5% Significance Level |                                         |   |         |   |   |   |  |
| 1401 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1402 |                                                                                                                                          |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1403 | <b>Gamma Statistics</b>                                                                                                                  |   |   |           |                                                                 |                                         |   |         |   |   |   |  |
| 1404 | k hat (MLE)                                                                                                                              |   |   | 26.07     | k star (bias corrected MLE)                                     |                                         |   | 10.56   |   |   |   |  |
| 1405 | Theta hat (MLE)                                                                                                                          |   |   | 8.0532E-4 | Theta star (bias corrected MLE)                                 |                                         |   | 0.00199 |   |   |   |  |
| 1406 | nu hat (MLE)                                                                                                                             |   |   | 260.7     | nu star (bias corrected)                                        |                                         |   | 105.6   |   |   |   |  |
| 1407 | MLE Mean (bias corrected)                                                                                                                |   |   | 0.021     | MLE Sd (bias corrected)                                         |                                         |   | 0.00646 |   |   |   |  |

| A    | B                                                                                                                                        | C | D | E      | F                                              | G                                   | H | I | J      | K     | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|------------------------------------------------|-------------------------------------|---|---|--------|-------|---|
| 1408 |                                                                                                                                          |   |   |        |                                                | Approximate Chi Square Value (0.05) |   |   |        | 82.91 |   |
| 1409 | Adjusted Level of Significance                                                                                                           |   |   | 0.0086 | Adjusted Chi Square Value                      |                                     |   |   | 74.14  |       |   |
| 1410 |                                                                                                                                          |   |   |        |                                                |                                     |   |   |        |       |   |
| 1411 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |        |                                                |                                     |   |   |        |       |   |
| 1412 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |   | 0.0268 | 95% Adjusted Gamma UCL (use when n<50)         |                                     |   |   | 0.0299 |       |   |
| 1413 |                                                                                                                                          |   |   |        |                                                |                                     |   |   |        |       |   |
| 1414 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |        |                                                |                                     |   |   |        |       |   |
| 1415 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.978  | <b>Shapiro Wilk Lognormal GOF Test</b>         |                                     |   |   |        |       |   |
| 1416 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.762  | Data appear Lognormal at 5% Significance Level |                                     |   |   |        |       |   |
| 1417 | Lilliefors Test Statistic                                                                                                                |   |   | 0.167  | <b>Lilliefors Lognormal GOF Test</b>           |                                     |   |   |        |       |   |
| 1418 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.343  | Data appear Lognormal at 5% Significance Level |                                     |   |   |        |       |   |
| 1419 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |        |                                                |                                     |   |   |        |       |   |
| 1420 |                                                                                                                                          |   |   |        |                                                |                                     |   |   |        |       |   |
| 1421 | <b>Lognormal Statistics</b>                                                                                                              |   |   |        |                                                |                                     |   |   |        |       |   |
| 1422 | Minimum of Logged Data                                                                                                                   |   |   | -4.206 | Mean of logged Data                            |                                     |   |   | -3.883 |       |   |
| 1423 | Maximum of Logged Data                                                                                                                   |   |   | -3.627 | SD of logged Data                              |                                     |   |   | 0.223  |       |   |
| 1424 |                                                                                                                                          |   |   |        |                                                |                                     |   |   |        |       |   |
| 1425 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |        |                                                |                                     |   |   |        |       |   |
| 1426 | 95% H-UCL                                                                                                                                |   |   | 0.0271 | 90% Chebyshev (MVUE) UCL                       |                                     |   |   | 0.0273 |       |   |
| 1427 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 0.0301 | 97.5% Chebyshev (MVUE) UCL                     |                                     |   |   | 0.0341 |       |   |
| 1428 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 0.0418 |                                                |                                     |   |   |        |       |   |
| 1429 |                                                                                                                                          |   |   |        |                                                |                                     |   |   |        |       |   |
| 1430 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |                                                |                                     |   |   |        |       |   |
| 1431 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |        |                                                |                                     |   |   |        |       |   |
| 1432 |                                                                                                                                          |   |   |        |                                                |                                     |   |   |        |       |   |
| 1433 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |        |                                                |                                     |   |   |        |       |   |
| 1434 | 95% CLT UCL                                                                                                                              |   |   | 0.0243 | 95% Jackknife UCL                              |                                     |   |   | 0.0253 |       |   |
| 1435 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 0.0239 | 95% Bootstrap-t UCL                            |                                     |   |   | 0.0248 |       |   |
| 1436 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 0.0243 | 95% Percentile Bootstrap UCL                   |                                     |   |   | 0.0239 |       |   |
| 1437 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 0.0237 |                                                |                                     |   |   |        |       |   |
| 1438 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 0.027  | 95% Chebyshev(Mean, Sd) UCL                    |                                     |   |   | 0.0297 |       |   |
| 1439 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 0.0335 | 99% Chebyshev(Mean, Sd) UCL                    |                                     |   |   | 0.041  |       |   |
| 1440 |                                                                                                                                          |   |   |        |                                                |                                     |   |   |        |       |   |
| 1441 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                |                                     |   |   |        |       |   |
| 1442 | 95% Student's-t UCL                                                                                                                      |   |   | 0.0253 |                                                |                                     |   |   |        |       |   |
| 1443 |                                                                                                                                          |   |   |        |                                                |                                     |   |   |        |       |   |
| 1444 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                |                                     |   |   |        |       |   |
| 1445 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                |                                     |   |   |        |       |   |
| 1446 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                |                                     |   |   |        |       |   |
| 1447 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                |                                     |   |   |        |       |   |
| 1448 |                                                                                                                                          |   |   |        |                                                |                                     |   |   |        |       |   |
| 1449 | <b>Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be</b>                 |   |   |        |                                                |                                     |   |   |        |       |   |
| 1450 | <b>reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.</b>                                       |   |   |        |                                                |                                     |   |   |        |       |   |
| 1451 |                                                                                                                                          |   |   |        |                                                |                                     |   |   |        |       |   |
| 1452 |                                                                                                                                          |   |   |        |                                                |                                     |   |   |        |       |   |
| 1453 | <b>Result (eu9_strontium)</b>                                                                                                            |   |   |        |                                                |                                     |   |   |        |       |   |
| 1454 |                                                                                                                                          |   |   |        |                                                |                                     |   |   |        |       |   |
| 1455 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                |                                     |   |   |        |       |   |
| 1456 | Total Number of Observations                                                                                                             |   |   | 5      | Number of Distinct Observations                |                                     |   |   | 5      |       |   |
| 1457 |                                                                                                                                          |   |   |        | Number of Missing Observations                 |                                     |   |   | 0      |       |   |
| 1458 | Minimum                                                                                                                                  |   |   | 0.309  | Mean                                           |                                     |   |   | 0.484  |       |   |
| 1459 | Maximum                                                                                                                                  |   |   | 0.898  | Median                                         |                                     |   |   | 0.374  |       |   |
| 1460 | SD                                                                                                                                       |   |   | 0.239  | Std. Error of Mean                             |                                     |   |   | 0.107  |       |   |
| 1461 | Coefficient of Variation                                                                                                                 |   |   | 0.495  | Skewness                                       |                                     |   |   | 1.903  |       |   |
| 1462 |                                                                                                                                          |   |   |        |                                                |                                     |   |   |        |       |   |
| 1463 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |   |   |        |                                                |                                     |   |   |        |       |   |
| 1464 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |   |   |        |                                                |                                     |   |   |        |       |   |
| 1465 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |   |   |        |                                                |                                     |   |   |        |       |   |
| 1466 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |   |   |        |                                                |                                     |   |   |        |       |   |
| 1467 |                                                                                                                                          |   |   |        |                                                |                                     |   |   |        |       |   |
| 1468 | <b>Normal GOF Test</b>                                                                                                                   |   |   |        |                                                |                                     |   |   |        |       |   |
| 1469 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.766  | <b>Shapiro Wilk GOF Test</b>                   |                                     |   |   |        |       |   |
| 1470 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.762  | Data appear Normal at 5% Significance Level    |                                     |   |   |        |       |   |
| 1471 | Lilliefors Test Statistic                                                                                                                |   |   | 0.312  | <b>Lilliefors GOF Test</b>                     |                                     |   |   |        |       |   |
| 1472 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.343  | Data appear Normal at 5% Significance Level    |                                     |   |   |        |       |   |
| 1473 | <b>Data appear Normal at 5% Significance Level</b>                                                                                       |   |   |        |                                                |                                     |   |   |        |       |   |
| 1474 |                                                                                                                                          |   |   |        |                                                |                                     |   |   |        |       |   |

|      | A                                                                                                                                        | B | C | D      | E | F | G                                                               | H | I | J      | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|---|---|-----------------------------------------------------------------|---|---|--------|---|---|
| 1475 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1476 | <b>95% Normal UCL</b>                                                                                                                    |   |   |        |   |   | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |        |   |   |
| 1477 | 95% Student's-t UCL                                                                                                                      |   |   | 0.712  |   |   | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   | 0.757  |   |   |
| 1478 |                                                                                                                                          |   |   |        |   |   | 95% Modified-t UCL (Johnson-1978)                               |   |   | 0.727  |   |   |
| 1479 |                                                                                                                                          |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1480 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1481 | A-D Test Statistic                                                                                                                       |   |   | 0.551  |   |   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |        |   |   |
| 1482 | 5% A-D Critical Value                                                                                                                    |   |   | 0.68   |   |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |        |   |   |
| 1483 | K-S Test Statistic                                                                                                                       |   |   | 0.289  |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |        |   |   |
| 1484 | 5% K-S Critical Value                                                                                                                    |   |   | 0.358  |   |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |        |   |   |
| 1485 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1486 |                                                                                                                                          |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1487 | <b>Gamma Statistics</b>                                                                                                                  |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1488 | k hat (MLE)                                                                                                                              |   |   | 6.508  |   |   | k star (bias corrected MLE)                                     |   |   | 2.737  |   |   |
| 1489 | Theta hat (MLE)                                                                                                                          |   |   | 0.0743 |   |   | Theta star (bias corrected MLE)                                 |   |   | 0.177  |   |   |
| 1490 | nu hat (MLE)                                                                                                                             |   |   | 65.08  |   |   | nu star (bias corrected)                                        |   |   | 27.37  |   |   |
| 1491 | MLE Mean (bias corrected)                                                                                                                |   |   | 0.484  |   |   | MLE Sd (bias corrected)                                         |   |   | 0.292  |   |   |
| 1492 |                                                                                                                                          |   |   |        |   |   | Approximate Chi Square Value (0.05)                             |   |   | 16.44  |   |   |
| 1493 | Adjusted Level of Significance                                                                                                           |   |   | 0.0086 |   |   | Adjusted Chi Square Value                                       |   |   | 12.88  |   |   |
| 1494 |                                                                                                                                          |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1495 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1496 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |   | 0.805  |   |   | 95% Adjusted Gamma UCL (use when n<50)                          |   |   | 1.027  |   |   |
| 1497 |                                                                                                                                          |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1498 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1499 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.854  |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |        |   |   |
| 1500 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.762  |   |   | Data appear Lognormal at 5% Significance Level                  |   |   |        |   |   |
| 1501 | Lilliefors Test Statistic                                                                                                                |   |   | 0.263  |   |   | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |        |   |   |
| 1502 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.343  |   |   | Data appear Lognormal at 5% Significance Level                  |   |   |        |   |   |
| 1503 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1504 |                                                                                                                                          |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1505 | <b>Lognormal Statistics</b>                                                                                                              |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1506 | Minimum of Logged Data                                                                                                                   |   |   | -1.173 |   |   | Mean of logged Data                                             |   |   | -0.805 |   |   |
| 1507 | Maximum of Logged Data                                                                                                                   |   |   | -0.108 |   |   | SD of logged Data                                               |   |   | 0.419  |   |   |
| 1508 |                                                                                                                                          |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1509 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1510 | 95% H-UCL                                                                                                                                |   |   | 0.861  |   |   | 90% Chebyshev (MVUE) UCL                                        |   |   | 0.747  |   |   |
| 1511 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 0.868  |   |   | 97.5% Chebyshev (MVUE) UCL                                      |   |   | 1.037  |   |   |
| 1512 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 1.368  |   |   |                                                                 |   |   |        |   |   |
| 1513 |                                                                                                                                          |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1514 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1515 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1516 |                                                                                                                                          |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1517 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1518 | 95% CLT UCL                                                                                                                              |   |   | 0.66   |   |   | 95% Jackknife UCL                                               |   |   | 0.712  |   |   |
| 1519 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 0.638  |   |   | 95% Bootstrap-t UCL                                             |   |   | 1.574  |   |   |
| 1520 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 1.788  |   |   | 95% Percentile Bootstrap UCL                                    |   |   | 0.673  |   |   |
| 1521 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 0.706  |   |   |                                                                 |   |   |        |   |   |
| 1522 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 0.805  |   |   | 95% Chebyshev(Mean, Sd) UCL                                     |   |   | 0.95   |   |   |
| 1523 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 1.152  |   |   | 99% Chebyshev(Mean, Sd) UCL                                     |   |   | 1.548  |   |   |
| 1524 |                                                                                                                                          |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1525 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1526 | 95% Student's-t UCL                                                                                                                      |   |   | 0.712  |   |   |                                                                 |   |   |        |   |   |
| 1527 |                                                                                                                                          |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1528 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1529 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1530 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1531 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1532 |                                                                                                                                          |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1533 | <b>Result (eu9_thallium)</b>                                                                                                             |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1534 |                                                                                                                                          |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1535 | <b>General Statistics</b>                                                                                                                |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1536 | Total Number of Observations                                                                                                             |   |   | 5      |   |   | Number of Distinct Observations                                 |   |   | 5      |   |   |
| 1537 | Number of Detects                                                                                                                        |   |   | 0      |   |   | Number of Non-Detects                                           |   |   | 5      |   |   |
| 1538 | Number of Distinct Detects                                                                                                               |   |   | 0      |   |   | Number of Distinct Non-Detects                                  |   |   | 5      |   |   |
| 1539 |                                                                                                                                          |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1540 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                       |   |   |        |   |   |                                                                 |   |   |        |   |   |
| 1541 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>                 |   |   |        |   |   |                                                                 |   |   |        |   |   |

| A    | B                                                                                                                          | C      | D                                                               | E | F     | G | H | I | J | K | L |
|------|----------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------------------|---|-------|---|---|---|---|---|---|
| 1542 | The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV). |        |                                                                 |   |       |   |   |   |   |   |   |
| 1543 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 1544 | The data set for variable Result (eu9_thallium) was not processed!                                                         |        |                                                                 |   |       |   |   |   |   |   |   |
| 1545 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 1546 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 1547 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 1548 | Result (eu9_zinc)                                                                                                          |        |                                                                 |   |       |   |   |   |   |   |   |
| 1549 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 1550 | General Statistics                                                                                                         |        |                                                                 |   |       |   |   |   |   |   |   |
| 1551 | Total Number of Observations                                                                                               | 5      | Number of Distinct Observations                                 |   | 5     |   |   |   |   |   |   |
| 1552 |                                                                                                                            |        | Number of Missing Observations                                  |   | 0     |   |   |   |   |   |   |
| 1553 | Minimum                                                                                                                    | 9.315  | Mean                                                            |   | 13.49 |   |   |   |   |   |   |
| 1554 | Maximum                                                                                                                    | 21.2   | Median                                                          |   | 11.42 |   |   |   |   |   |   |
| 1555 | SD                                                                                                                         | 4.794  | Std. Error of Mean                                              |   | 2.144 |   |   |   |   |   |   |
| 1556 | Coefficient of Variation                                                                                                   | 0.355  | Skewness                                                        |   | 1.341 |   |   |   |   |   |   |
| 1557 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 1558 | Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use                           |        |                                                                 |   |       |   |   |   |   |   |   |
| 1559 | guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 1560 | For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).                                               |        |                                                                 |   |       |   |   |   |   |   |   |
| 1561 | Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1                                    |        |                                                                 |   |       |   |   |   |   |   |   |
| 1562 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 1563 | Normal GOF Test                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 1564 | Shapiro Wilk Test Statistic                                                                                                | 0.874  | Shapiro Wilk GOF Test                                           |   |       |   |   |   |   |   |   |
| 1565 | 5% Shapiro Wilk Critical Value                                                                                             | 0.762  | Data appear Normal at 5% Significance Level                     |   |       |   |   |   |   |   |   |
| 1566 | Lilliefors Test Statistic                                                                                                  | 0.267  | Lilliefors GOF Test                                             |   |       |   |   |   |   |   |   |
| 1567 | 5% Lilliefors Critical Value                                                                                               | 0.343  | Data appear Normal at 5% Significance Level                     |   |       |   |   |   |   |   |   |
| 1568 | Data appear Normal at 5% Significance Level                                                                                |        |                                                                 |   |       |   |   |   |   |   |   |
| 1569 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 1570 | Assuming Normal Distribution                                                                                               |        |                                                                 |   |       |   |   |   |   |   |   |
| 1571 | 95% Normal UCL                                                                                                             |        | 95% UCLs (Adjusted for Skewness)                                |   |       |   |   |   |   |   |   |
| 1572 | 95% Student's-t UCL                                                                                                        | 18.06  | 95% Adjusted-CLT UCL (Chen-1995)                                |   | 18.39 |   |   |   |   |   |   |
| 1573 |                                                                                                                            |        | 95% Modified-t UCL (Johnson-1978)                               |   | 18.28 |   |   |   |   |   |   |
| 1574 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 1575 | Gamma GOF Test                                                                                                             |        |                                                                 |   |       |   |   |   |   |   |   |
| 1576 | A-D Test Statistic                                                                                                         | 0.351  | Anderson-Darling Gamma GOF Test                                 |   |       |   |   |   |   |   |   |
| 1577 | 5% A-D Critical Value                                                                                                      | 0.679  | Detected data appear Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |   |   |
| 1578 | K-S Test Statistic                                                                                                         | 0.27   | Kolmogorov-Smirnov Gamma GOF Test                               |   |       |   |   |   |   |   |   |
| 1579 | 5% K-S Critical Value                                                                                                      | 0.358  | Detected data appear Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |   |   |
| 1580 | Detected data appear Gamma Distributed at 5% Significance Level                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 1581 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 1582 | Gamma Statistics                                                                                                           |        |                                                                 |   |       |   |   |   |   |   |   |
| 1583 | k hat (MLE)                                                                                                                | 11.19  | k star (bias corrected MLE)                                     |   | 4.608 |   |   |   |   |   |   |
| 1584 | Theta hat (MLE)                                                                                                            | 1.206  | Theta star (bias corrected MLE)                                 |   | 2.927 |   |   |   |   |   |   |
| 1585 | nu hat (MLE)                                                                                                               | 111.9  | nu star (bias corrected)                                        |   | 46.08 |   |   |   |   |   |   |
| 1586 | MLE Mean (bias corrected)                                                                                                  | 13.49  | MLE Sd (bias corrected)                                         |   | 6.284 |   |   |   |   |   |   |
| 1587 |                                                                                                                            |        | Approximate Chi Square Value (0.05)                             |   | 31.51 |   |   |   |   |   |   |
| 1588 | Adjusted Level of Significance                                                                                             | 0.0086 | Adjusted Chi Square Value                                       |   | 26.35 |   |   |   |   |   |   |
| 1589 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 1590 | Assuming Gamma Distribution                                                                                                |        |                                                                 |   |       |   |   |   |   |   |   |
| 1591 | 95% Approximate Gamma UCL (use when n>=50))                                                                                | 19.73  | 95% Adjusted Gamma UCL (use when n<50)                          |   | 23.59 |   |   |   |   |   |   |
| 1592 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 1593 | Lognormal GOF Test                                                                                                         |        |                                                                 |   |       |   |   |   |   |   |   |
| 1594 | Shapiro Wilk Test Statistic                                                                                                | 0.925  | Shapiro Wilk Lognormal GOF Test                                 |   |       |   |   |   |   |   |   |
| 1595 | 5% Shapiro Wilk Critical Value                                                                                             | 0.762  | Data appear Lognormal at 5% Significance Level                  |   |       |   |   |   |   |   |   |
| 1596 | Lilliefors Test Statistic                                                                                                  | 0.244  | Lilliefors Lognormal GOF Test                                   |   |       |   |   |   |   |   |   |
| 1597 | 5% Lilliefors Critical Value                                                                                               | 0.343  | Data appear Lognormal at 5% Significance Level                  |   |       |   |   |   |   |   |   |
| 1598 | Data appear Lognormal at 5% Significance Level                                                                             |        |                                                                 |   |       |   |   |   |   |   |   |
| 1599 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 1600 | Lognormal Statistics                                                                                                       |        |                                                                 |   |       |   |   |   |   |   |   |
| 1601 | Minimum of Logged Data                                                                                                     | 2.232  | Mean of logged Data                                             |   | 2.557 |   |   |   |   |   |   |
| 1602 | Maximum of Logged Data                                                                                                     | 3.054  | SD of logged Data                                               |   | 0.328 |   |   |   |   |   |   |
| 1603 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 1604 | Assuming Lognormal Distribution                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 1605 | 95% H-UCL                                                                                                                  | 20.38  | 90% Chebyshev (MVUE) UCL                                        |   | 19.35 |   |   |   |   |   |   |
| 1606 | 95% Chebyshev (MVUE) UCL                                                                                                   | 22.02  | 97.5% Chebyshev (MVUE) UCL                                      |   | 25.73 |   |   |   |   |   |   |
| 1607 | 99% Chebyshev (MVUE) UCL                                                                                                   | 33.01  |                                                                 |   |       |   |   |   |   |   |   |
| 1608 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |

|      | A                                                                                                                                        | B | C | D     | E | F | G                            | H | I | J     | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|-------|---|---|------------------------------|---|---|-------|---|---|
| 1609 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |       |   |   |                              |   |   |       |   |   |
| 1610 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |       |   |   |                              |   |   |       |   |   |
| 1611 |                                                                                                                                          |   |   |       |   |   |                              |   |   |       |   |   |
| 1612 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |       |   |   |                              |   |   |       |   |   |
| 1613 | 95% CLT UCL                                                                                                                              |   |   | 17.02 |   |   | 95% Jackknife UCL            |   |   | 18.06 |   |   |
| 1614 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 16.57 |   |   | 95% Bootstrap-t UCL          |   |   | 29.24 |   |   |
| 1615 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 40.13 |   |   | 95% Percentile Bootstrap UCL |   |   | 16.75 |   |   |
| 1616 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 17.82 |   |   |                              |   |   |       |   |   |
| 1617 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 19.92 |   |   | 95% Chebyshev(Mean, Sd) UCL  |   |   | 22.84 |   |   |
| 1618 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 26.88 |   |   | 99% Chebyshev(Mean, Sd) UCL  |   |   | 34.82 |   |   |
| 1619 |                                                                                                                                          |   |   |       |   |   |                              |   |   |       |   |   |
| 1620 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |       |   |   |                              |   |   |       |   |   |
| 1621 | 95% Student's-t UCL                                                                                                                      |   |   | 18.06 |   |   |                              |   |   |       |   |   |
| 1622 |                                                                                                                                          |   |   |       |   |   |                              |   |   |       |   |   |
| 1623 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |       |   |   |                              |   |   |       |   |   |
| 1624 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |       |   |   |                              |   |   |       |   |   |
| 1625 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |       |   |   |                              |   |   |       |   |   |
| 1626 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |       |   |   |                              |   |   |       |   |   |
| 1627 |                                                                                                                                          |   |   |       |   |   |                              |   |   |       |   |   |

|    | A                                                                                                                                 | B | C                              | D      | E | F                               | G | H | I      | J | K | L |
|----|-----------------------------------------------------------------------------------------------------------------------------------|---|--------------------------------|--------|---|---------------------------------|---|---|--------|---|---|---|
| 1  | <b>UCL Statistics for Data Sets with Non-Detects</b>                                                                              |   |                                |        |   |                                 |   |   |        |   |   |   |
| 2  |                                                                                                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |
| 3  | User Selected Options                                                                                                             |   |                                |        |   |                                 |   |   |        |   |   |   |
| 4  | Date/Time of Computation                                                                                                          |   | ProUCL 5.12/11/2019 2:17:36 PM |        |   |                                 |   |   |        |   |   |   |
| 5  | From File                                                                                                                         |   | BPMD_HHRA_Gamelnput_v2.xls     |        |   |                                 |   |   |        |   |   |   |
| 6  | Full Precision                                                                                                                    |   | OFF                            |        |   |                                 |   |   |        |   |   |   |
| 7  | Confidence Coefficient                                                                                                            |   | 95%                            |        |   |                                 |   |   |        |   |   |   |
| 8  | Number of Bootstrap Operations                                                                                                    |   | 2000                           |        |   |                                 |   |   |        |   |   |   |
| 9  |                                                                                                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |
| 10 | <b>Result (deermuscle_antimony)</b>                                                                                               |   |                                |        |   |                                 |   |   |        |   |   |   |
| 11 |                                                                                                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |
| 12 | <b>General Statistics</b>                                                                                                         |   |                                |        |   |                                 |   |   |        |   |   |   |
| 13 | Total Number of Observations                                                                                                      |   |                                | 8      |   | Number of Distinct Observations |   |   | 8      |   |   |   |
| 14 | Number of Detects                                                                                                                 |   |                                | 0      |   | Number of Non-Detects           |   |   | 8      |   |   |   |
| 15 | Number of Distinct Detects                                                                                                        |   |                                | 0      |   | Number of Distinct Non-Detects  |   |   | 8      |   |   |   |
| 16 |                                                                                                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |
| 17 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                |   |                                |        |   |                                 |   |   |        |   |   |   |
| 18 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>          |   |                                |        |   |                                 |   |   |        |   |   |   |
| 19 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b> |   |                                |        |   |                                 |   |   |        |   |   |   |
| 20 |                                                                                                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |
| 21 | <b>The data set for variable Result (deermuscle_antimony) was not processed!</b>                                                  |   |                                |        |   |                                 |   |   |        |   |   |   |
| 22 |                                                                                                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |
| 23 |                                                                                                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |
| 24 | <b>Result (deermuscle_arsenic)</b>                                                                                                |   |                                |        |   |                                 |   |   |        |   |   |   |
| 25 |                                                                                                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |
| 26 | <b>General Statistics</b>                                                                                                         |   |                                |        |   |                                 |   |   |        |   |   |   |
| 27 | Total Number of Observations                                                                                                      |   |                                | 8      |   | Number of Distinct Observations |   |   | 8      |   |   |   |
| 28 | Number of Detects                                                                                                                 |   |                                | 0      |   | Number of Non-Detects           |   |   | 8      |   |   |   |
| 29 | Number of Distinct Detects                                                                                                        |   |                                | 0      |   | Number of Distinct Non-Detects  |   |   | 8      |   |   |   |
| 30 |                                                                                                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |
| 31 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                |   |                                |        |   |                                 |   |   |        |   |   |   |
| 32 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>          |   |                                |        |   |                                 |   |   |        |   |   |   |
| 33 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b> |   |                                |        |   |                                 |   |   |        |   |   |   |
| 34 |                                                                                                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |
| 35 | <b>The data set for variable Result (deermuscle_arsenic) was not processed!</b>                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |
| 36 |                                                                                                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |
| 37 |                                                                                                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |
| 38 | <b>Result (deermuscle_cadmium)</b>                                                                                                |   |                                |        |   |                                 |   |   |        |   |   |   |
| 39 |                                                                                                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |
| 40 | <b>General Statistics</b>                                                                                                         |   |                                |        |   |                                 |   |   |        |   |   |   |
| 41 | Total Number of Observations                                                                                                      |   |                                | 8      |   | Number of Distinct Observations |   |   | 8      |   |   |   |
| 42 | Number of Detects                                                                                                                 |   |                                | 0      |   | Number of Non-Detects           |   |   | 8      |   |   |   |
| 43 | Number of Distinct Detects                                                                                                        |   |                                | 0      |   | Number of Distinct Non-Detects  |   |   | 8      |   |   |   |
| 44 |                                                                                                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |
| 45 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                |   |                                |        |   |                                 |   |   |        |   |   |   |
| 46 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>          |   |                                |        |   |                                 |   |   |        |   |   |   |
| 47 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b> |   |                                |        |   |                                 |   |   |        |   |   |   |
| 48 |                                                                                                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |
| 49 | <b>The data set for variable Result (deermuscle_cadmium) was not processed!</b>                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |
| 50 |                                                                                                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |
| 51 |                                                                                                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |
| 52 |                                                                                                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |
| 53 | <b>Result (deermuscle_chromium)</b>                                                                                               |   |                                |        |   |                                 |   |   |        |   |   |   |
| 54 |                                                                                                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |
| 55 | <b>General Statistics</b>                                                                                                         |   |                                |        |   |                                 |   |   |        |   |   |   |
| 56 | Total Number of Observations                                                                                                      |   |                                | 8      |   | Number of Distinct Observations |   |   | 8      |   |   |   |
| 57 |                                                                                                                                   |   |                                |        |   | Number of Missing Observations  |   |   | 0      |   |   |   |
| 58 | Minimum                                                                                                                           |   |                                | 0.668  |   | Mean                            |   |   | 0.748  |   |   |   |
| 59 | Maximum                                                                                                                           |   |                                | 0.796  |   | Median                          |   |   | 0.752  |   |   |   |
| 60 | SD                                                                                                                                |   |                                | 0.0419 |   | Std. Error of Mean              |   |   | 0.0148 |   |   |   |
| 61 | Coefficient of Variation                                                                                                          |   |                                | 0.056  |   | Skewness                        |   |   | -0.933 |   |   |   |
| 62 |                                                                                                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |
| 63 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                        |   |                                |        |   |                                 |   |   |        |   |   |   |
| 64 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                            |   |                                |        |   |                                 |   |   |        |   |   |   |
| 65 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                               |   |                                |        |   |                                 |   |   |        |   |   |   |
| 66 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                    |   |                                |        |   |                                 |   |   |        |   |   |   |
| 67 |                                                                                                                                   |   |                                |        |   |                                 |   |   |        |   |   |   |

|     | A                                                                                                                                         | B | C       | D                                                               | E | G | H | I | J | K       | L |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------|---|---------|-----------------------------------------------------------------|---|---|---|---|---|---------|---|
| 68  | <b>Normal GOF Test</b>                                                                                                                    |   |         |                                                                 |   |   |   |   |   |         |   |
| 69  | Shapiro Wilk Test Statistic                                                                                                               |   | 0.937   | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |   |   |         |   |
| 70  | 5% Shapiro Wilk Critical Value                                                                                                            |   | 0.818   | Data appear Normal at 5% Significance Level                     |   |   |   |   |   |         |   |
| 71  | Lilliefors Test Statistic                                                                                                                 |   | 0.2     | <b>Lilliefors GOF Test</b>                                      |   |   |   |   |   |         |   |
| 72  | 5% Lilliefors Critical Value                                                                                                              |   | 0.283   | Data appear Normal at 5% Significance Level                     |   |   |   |   |   |         |   |
| 73  | <b>Data appear Normal at 5% Significance Level</b>                                                                                        |   |         |                                                                 |   |   |   |   |   |         |   |
| 74  |                                                                                                                                           |   |         |                                                                 |   |   |   |   |   |         |   |
| 75  | <b>Assuming Normal Distribution</b>                                                                                                       |   |         |                                                                 |   |   |   |   |   |         |   |
| 76  | <b>95% Normal UCL</b>                                                                                                                     |   |         | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |   |   |   |         |   |
| 77  | 95% Student's-t UCL                                                                                                                       |   | 0.776   | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |   |   |   | 0.767   |   |
| 78  |                                                                                                                                           |   |         | 95% Modified-t UCL (Johnson-1978)                               |   |   |   |   |   | 0.775   |   |
| 79  |                                                                                                                                           |   |         |                                                                 |   |   |   |   |   |         |   |
| 80  | <b>Gamma GOF Test</b>                                                                                                                     |   |         |                                                                 |   |   |   |   |   |         |   |
| 81  | A-D Test Statistic                                                                                                                        |   | 0.301   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |   |   |   |         |   |
| 82  | 5% A-D Critical Value                                                                                                                     |   | 0.715   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |   |   |         |   |
| 83  | K-S Test Statistic                                                                                                                        |   | 0.205   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |   |   |   |         |   |
| 84  | 5% K-S Critical Value                                                                                                                     |   | 0.294   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |   |   |         |   |
| 85  | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                    |   |         |                                                                 |   |   |   |   |   |         |   |
| 86  |                                                                                                                                           |   |         |                                                                 |   |   |   |   |   |         |   |
| 87  | <b>Gamma Statistics</b>                                                                                                                   |   |         |                                                                 |   |   |   |   |   |         |   |
| 88  | k hat (MLE)                                                                                                                               |   | 354.1   | k star (bias corrected MLE)                                     |   |   |   |   |   | 221.4   |   |
| 89  | Theta hat (MLE)                                                                                                                           |   | 0.00211 | Theta star (bias corrected MLE)                                 |   |   |   |   |   | 0.00338 |   |
| 90  | nu hat (MLE)                                                                                                                              |   | 5665    | nu star (bias corrected)                                        |   |   |   |   |   | 3542    |   |
| 91  | MLE Mean (bias corrected)                                                                                                                 |   | 0.748   | MLE Sd (bias corrected)                                         |   |   |   |   |   | 0.0503  |   |
| 92  |                                                                                                                                           |   |         | Approximate Chi Square Value (0.05)                             |   |   |   |   |   | 3405    |   |
| 93  | Adjusted Level of Significance                                                                                                            |   | 0.0195  | Adjusted Chi Square Value                                       |   |   |   |   |   | 3370    |   |
| 94  |                                                                                                                                           |   |         |                                                                 |   |   |   |   |   |         |   |
| 95  | <b>Assuming Gamma Distribution</b>                                                                                                        |   |         |                                                                 |   |   |   |   |   |         |   |
| 96  | 95% Approximate Gamma UCL (use when n>=50)                                                                                                |   | 0.778   | 95% Adjusted Gamma UCL (use when n<50)                          |   |   |   |   |   | 0.786   |   |
| 97  |                                                                                                                                           |   |         |                                                                 |   |   |   |   |   |         |   |
| 98  | <b>Lognormal GOF Test</b>                                                                                                                 |   |         |                                                                 |   |   |   |   |   |         |   |
| 99  | Shapiro Wilk Test Statistic                                                                                                               |   | 0.926   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |   |   |   |         |   |
| 100 | 5% Shapiro Wilk Critical Value                                                                                                            |   | 0.818   | Data appear Lognormal at 5% Significance Level                  |   |   |   |   |   |         |   |
| 101 | Lilliefors Test Statistic                                                                                                                 |   | 0.211   | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |   |   |   |         |   |
| 102 | 5% Lilliefors Critical Value                                                                                                              |   | 0.283   | Data appear Lognormal at 5% Significance Level                  |   |   |   |   |   |         |   |
| 103 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                     |   |         |                                                                 |   |   |   |   |   |         |   |
| 104 |                                                                                                                                           |   |         |                                                                 |   |   |   |   |   |         |   |
| 105 | <b>Lognormal Statistics</b>                                                                                                               |   |         |                                                                 |   |   |   |   |   |         |   |
| 106 | Minimum of Logged Data                                                                                                                    |   | -0.403  | Mean of logged Data                                             |   |   |   |   |   | -0.292  |   |
| 107 | Maximum of Logged Data                                                                                                                    |   | -0.228  | SD of logged Data                                               |   |   |   |   |   | 0.0573  |   |
| 108 |                                                                                                                                           |   |         |                                                                 |   |   |   |   |   |         |   |
| 109 | <b>Assuming Lognormal Distribution</b>                                                                                                    |   |         |                                                                 |   |   |   |   |   |         |   |
| 110 | 95% H-UCL                                                                                                                                 |   | N/A     | 90% Chebyshev (MVUE) UCL                                        |   |   |   |   |   | 0.793   |   |
| 111 | 95% Chebyshev (MVUE) UCL                                                                                                                  |   | 0.814   | 97.5% Chebyshev (MVUE) UCL                                      |   |   |   |   |   | 0.842   |   |
| 112 | 99% Chebyshev (MVUE) UCL                                                                                                                  |   | 0.898   |                                                                 |   |   |   |   |   |         |   |
| 113 |                                                                                                                                           |   |         |                                                                 |   |   |   |   |   |         |   |
| 114 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                     |   |         |                                                                 |   |   |   |   |   |         |   |
| 115 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                          |   |         |                                                                 |   |   |   |   |   |         |   |
| 116 |                                                                                                                                           |   |         |                                                                 |   |   |   |   |   |         |   |
| 117 | <b>Nonparametric Distribution Free UCLs</b>                                                                                               |   |         |                                                                 |   |   |   |   |   |         |   |
| 118 | 95% CLT UCL                                                                                                                               |   | 0.772   | 95% Jackknife UCL                                               |   |   |   |   |   | 0.776   |   |
| 119 | 95% Standard Bootstrap UCL                                                                                                                |   | 0.771   | 95% Bootstrap-t UCL                                             |   |   |   |   |   | 0.772   |   |
| 120 | 95% Hall's Bootstrap UCL                                                                                                                  |   | 0.768   | 95% Percentile Bootstrap UCL                                    |   |   |   |   |   | 0.77    |   |
| 121 | 95% BCA Bootstrap UCL                                                                                                                     |   | 0.767   |                                                                 |   |   |   |   |   |         |   |
| 122 | 90% Chebyshev(Mean, Sd) UCL                                                                                                               |   | 0.792   | 95% Chebyshev(Mean, Sd) UCL                                     |   |   |   |   |   | 0.812   |   |
| 123 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                             |   | 0.84    | 99% Chebyshev(Mean, Sd) UCL                                     |   |   |   |   |   | 0.895   |   |
| 124 |                                                                                                                                           |   |         |                                                                 |   |   |   |   |   |         |   |
| 125 | <b>Suggested UCL to Use</b>                                                                                                               |   |         |                                                                 |   |   |   |   |   |         |   |
| 126 | 95% Student's-t UCL                                                                                                                       |   | 0.776   |                                                                 |   |   |   |   |   |         |   |
| 127 |                                                                                                                                           |   |         |                                                                 |   |   |   |   |   |         |   |
| 128 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |   |         |                                                                 |   |   |   |   |   |         |   |
| 129 | Recommendations are based upon data size, data distribution, and skewness.                                                                |   |         |                                                                 |   |   |   |   |   |         |   |
| 130 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |   |         |                                                                 |   |   |   |   |   |         |   |
| 131 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |   |         |                                                                 |   |   |   |   |   |         |   |
| 132 |                                                                                                                                           |   |         |                                                                 |   |   |   |   |   |         |   |
| 133 | <b>Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be</b>                  |   |         |                                                                 |   |   |   |   |   |         |   |
| 134 | <b>reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.</b>                                        |   |         |                                                                 |   |   |   |   |   |         |   |

| A   | B                                                                                                                                 | C      | D | E | F | G | H | I                                                               | J     | K | L |
|-----|-----------------------------------------------------------------------------------------------------------------------------------|--------|---|---|---|---|---|-----------------------------------------------------------------|-------|---|---|
| 135 |                                                                                                                                   |        |   |   |   |   |   |                                                                 |       |   |   |
| 136 | <b>Result (deermuscle_cobalt)</b>                                                                                                 |        |   |   |   |   |   |                                                                 |       |   |   |
| 137 |                                                                                                                                   |        |   |   |   |   |   |                                                                 |       |   |   |
| 138 | <b>General Statistics</b>                                                                                                         |        |   |   |   |   |   |                                                                 |       |   |   |
| 139 | Total Number of Observations                                                                                                      | 8      |   |   |   |   |   | Number of Distinct Observations                                 | 8     |   |   |
| 140 | Number of Detects                                                                                                                 | 0      |   |   |   |   |   | Number of Non-Detects                                           | 8     |   |   |
| 141 | Number of Distinct Detects                                                                                                        | 0      |   |   |   |   |   | Number of Distinct Non-Detects                                  | 8     |   |   |
| 142 |                                                                                                                                   |        |   |   |   |   |   |                                                                 |       |   |   |
| 143 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                |        |   |   |   |   |   |                                                                 |       |   |   |
| 144 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>          |        |   |   |   |   |   |                                                                 |       |   |   |
| 145 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b> |        |   |   |   |   |   |                                                                 |       |   |   |
| 146 |                                                                                                                                   |        |   |   |   |   |   |                                                                 |       |   |   |
| 147 | <b>The data set for variable Result (deermuscle_cobalt) was not processed!</b>                                                    |        |   |   |   |   |   |                                                                 |       |   |   |
| 148 |                                                                                                                                   |        |   |   |   |   |   |                                                                 |       |   |   |
| 149 |                                                                                                                                   |        |   |   |   |   |   |                                                                 |       |   |   |
| 150 |                                                                                                                                   |        |   |   |   |   |   |                                                                 |       |   |   |
| 151 | <b>Result (deermuscle_iron)</b>                                                                                                   |        |   |   |   |   |   |                                                                 |       |   |   |
| 152 |                                                                                                                                   |        |   |   |   |   |   |                                                                 |       |   |   |
| 153 | <b>General Statistics</b>                                                                                                         |        |   |   |   |   |   |                                                                 |       |   |   |
| 154 | Total Number of Observations                                                                                                      | 8      |   |   |   |   |   | Number of Distinct Observations                                 | 8     |   |   |
| 155 |                                                                                                                                   |        |   |   |   |   |   | Number of Missing Observations                                  | 0     |   |   |
| 156 | Minimum                                                                                                                           | 14.55  |   |   |   |   |   | Mean                                                            | 24.74 |   |   |
| 157 | Maximum                                                                                                                           | 35.22  |   |   |   |   |   | Median                                                          | 23.99 |   |   |
| 158 | SD                                                                                                                                | 7.052  |   |   |   |   |   | Std. Error of Mean                                              | 2.493 |   |   |
| 159 | Coefficient of Variation                                                                                                          | 0.285  |   |   |   |   |   | Skewness                                                        | 0.353 |   |   |
| 160 |                                                                                                                                   |        |   |   |   |   |   |                                                                 |       |   |   |
| 161 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                        |        |   |   |   |   |   |                                                                 |       |   |   |
| 162 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                            |        |   |   |   |   |   |                                                                 |       |   |   |
| 163 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                               |        |   |   |   |   |   |                                                                 |       |   |   |
| 164 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                    |        |   |   |   |   |   |                                                                 |       |   |   |
| 165 |                                                                                                                                   |        |   |   |   |   |   |                                                                 |       |   |   |
| 166 | <b>Normal GOF Test</b>                                                                                                            |        |   |   |   |   |   |                                                                 |       |   |   |
| 167 | Shapiro Wilk Test Statistic                                                                                                       | 0.938  |   |   |   |   |   | <b>Shapiro Wilk GOF Test</b>                                    |       |   |   |
| 168 | 5% Shapiro Wilk Critical Value                                                                                                    | 0.818  |   |   |   |   |   | Data appear Normal at 5% Significance Level                     |       |   |   |
| 169 | Lilliefors Test Statistic                                                                                                         | 0.215  |   |   |   |   |   | <b>Lilliefors GOF Test</b>                                      |       |   |   |
| 170 | 5% Lilliefors Critical Value                                                                                                      | 0.283  |   |   |   |   |   | Data appear Normal at 5% Significance Level                     |       |   |   |
| 171 | <b>Data appear Normal at 5% Significance Level</b>                                                                                |        |   |   |   |   |   |                                                                 |       |   |   |
| 172 |                                                                                                                                   |        |   |   |   |   |   |                                                                 |       |   |   |
| 173 | <b>Assuming Normal Distribution</b>                                                                                               |        |   |   |   |   |   |                                                                 |       |   |   |
| 174 | <b>95% Normal UCL</b>                                                                                                             |        |   |   |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b>                         |       |   |   |
| 175 | 95% Student's-t UCL                                                                                                               | 29.46  |   |   |   |   |   | 95% Adjusted-CLT UCL (Chen-1995)                                | 29.17 |   |   |
| 176 |                                                                                                                                   |        |   |   |   |   |   | 95% Modified-t UCL (Johnson-1978)                               | 29.51 |   |   |
| 177 |                                                                                                                                   |        |   |   |   |   |   |                                                                 |       |   |   |
| 178 | <b>Gamma GOF Test</b>                                                                                                             |        |   |   |   |   |   |                                                                 |       |   |   |
| 179 | A-D Test Statistic                                                                                                                | 0.265  |   |   |   |   |   | <b>Anderson-Darling Gamma GOF Test</b>                          |       |   |   |
| 180 | 5% A-D Critical Value                                                                                                             | 0.715  |   |   |   |   |   | Detected data appear Gamma Distributed at 5% Significance Level |       |   |   |
| 181 | K-S Test Statistic                                                                                                                | 0.178  |   |   |   |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |       |   |   |
| 182 | 5% K-S Critical Value                                                                                                             | 0.294  |   |   |   |   |   | Detected data appear Gamma Distributed at 5% Significance Level |       |   |   |
| 183 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                            |        |   |   |   |   |   |                                                                 |       |   |   |
| 184 |                                                                                                                                   |        |   |   |   |   |   |                                                                 |       |   |   |
| 185 | <b>Gamma Statistics</b>                                                                                                           |        |   |   |   |   |   |                                                                 |       |   |   |
| 186 | k hat (MLE)                                                                                                                       | 13.86  |   |   |   |   |   | k star (bias corrected MLE)                                     | 8.747 |   |   |
| 187 | Theta hat (MLE)                                                                                                                   | 1.784  |   |   |   |   |   | Theta star (bias corrected MLE)                                 | 2.828 |   |   |
| 188 | nu hat (MLE)                                                                                                                      | 221.8  |   |   |   |   |   | nu star (bias corrected)                                        | 140   |   |   |
| 189 | MLE Mean (bias corrected)                                                                                                         | 24.74  |   |   |   |   |   | MLE Sd (bias corrected)                                         | 8.364 |   |   |
| 190 |                                                                                                                                   |        |   |   |   |   |   | Approximate Chi Square Value (0.05)                             | 113.6 |   |   |
| 191 | Adjusted Level of Significance                                                                                                    | 0.0195 |   |   |   |   |   | Adjusted Chi Square Value                                       | 107.6 |   |   |
| 192 |                                                                                                                                   |        |   |   |   |   |   |                                                                 |       |   |   |
| 193 | <b>Assuming Gamma Distribution</b>                                                                                                |        |   |   |   |   |   |                                                                 |       |   |   |
| 194 | 95% Approximate Gamma UCL (use when n>=50))                                                                                       | 30.47  |   |   |   |   |   | 95% Adjusted Gamma UCL (use when n<50)                          | 32.17 |   |   |
| 195 |                                                                                                                                   |        |   |   |   |   |   |                                                                 |       |   |   |
| 196 | <b>Lognormal GOF Test</b>                                                                                                         |        |   |   |   |   |   |                                                                 |       |   |   |
| 197 | Shapiro Wilk Test Statistic                                                                                                       | 0.954  |   |   |   |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |       |   |   |
| 198 | 5% Shapiro Wilk Critical Value                                                                                                    | 0.818  |   |   |   |   |   | Data appear Lognormal at 5% Significance Level                  |       |   |   |
| 199 | Lilliefors Test Statistic                                                                                                         | 0.167  |   |   |   |   |   | <b>Lilliefors Lognormal GOF Test</b>                            |       |   |   |
| 200 | 5% Lilliefors Critical Value                                                                                                      | 0.283  |   |   |   |   |   | Data appear Lognormal at 5% Significance Level                  |       |   |   |
| 201 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                             |        |   |   |   |   |   |                                                                 |       |   |   |

| A   | B                                                                                                                                        | C | D | E       | F | G                                 | H | I | J      | K | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---|---------|---|-----------------------------------|---|---|--------|---|---|
| 202 |                                                                                                                                          |   |   |         |   |                                   |   |   |        |   |   |
| 203 | <b>Lognormal Statistics</b>                                                                                                              |   |   |         |   |                                   |   |   |        |   |   |
| 204 | Minimum of Logged Data                                                                                                                   |   |   | 2.677   |   | Mean of logged Data               |   |   | 3.172  |   |   |
| 205 | Maximum of Logged Data                                                                                                                   |   |   | 3.562   |   | SD of logged Data                 |   |   | 0.292  |   |   |
| 206 |                                                                                                                                          |   |   |         |   |                                   |   |   |        |   |   |
| 207 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |         |   |                                   |   |   |        |   |   |
| 208 | 95% H-UCL                                                                                                                                |   |   | 31.2    |   | 90% Chebyshev (MVUE) UCL          |   |   | 32.45  |   |   |
| 209 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 35.93   |   | 97.5% Chebyshev (MVUE) UCL        |   |   | 40.77  |   |   |
| 210 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 50.28   |   |                                   |   |   |        |   |   |
| 211 |                                                                                                                                          |   |   |         |   |                                   |   |   |        |   |   |
| 212 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |         |   |                                   |   |   |        |   |   |
| 213 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |         |   |                                   |   |   |        |   |   |
| 214 |                                                                                                                                          |   |   |         |   |                                   |   |   |        |   |   |
| 215 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |         |   |                                   |   |   |        |   |   |
| 216 | 95% CLT UCL                                                                                                                              |   |   | 28.84   |   | 95% Jackknife UCL                 |   |   | 29.46  |   |   |
| 217 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 28.51   |   | 95% Bootstrap-t UCL               |   |   | 30.55  |   |   |
| 218 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 32.96   |   | 95% Percentile Bootstrap UCL      |   |   | 28.5   |   |   |
| 219 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 28.83   |   |                                   |   |   |        |   |   |
| 220 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 32.22   |   | 95% Chebyshev(Mean, Sd) UCL       |   |   | 35.6   |   |   |
| 221 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 40.31   |   | 99% Chebyshev(Mean, Sd) UCL       |   |   | 49.55  |   |   |
| 222 |                                                                                                                                          |   |   |         |   |                                   |   |   |        |   |   |
| 223 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |         |   |                                   |   |   |        |   |   |
| 224 | 95% Student's-t UCL                                                                                                                      |   |   | 29.46   |   |                                   |   |   |        |   |   |
| 225 |                                                                                                                                          |   |   |         |   |                                   |   |   |        |   |   |
| 226 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |         |   |                                   |   |   |        |   |   |
| 227 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |         |   |                                   |   |   |        |   |   |
| 228 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |         |   |                                   |   |   |        |   |   |
| 229 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |         |   |                                   |   |   |        |   |   |
| 230 |                                                                                                                                          |   |   |         |   |                                   |   |   |        |   |   |
| 231 | <b>Result (deermuscle_manganese)</b>                                                                                                     |   |   |         |   |                                   |   |   |        |   |   |
| 232 |                                                                                                                                          |   |   |         |   |                                   |   |   |        |   |   |
| 233 | <b>General Statistics</b>                                                                                                                |   |   |         |   |                                   |   |   |        |   |   |
| 234 | Total Number of Observations                                                                                                             |   |   | 8       |   | Number of Distinct Observations   |   |   | 8      |   |   |
| 235 | Number of Detects                                                                                                                        |   |   | 2       |   | Number of Non-Detects             |   |   | 6      |   |   |
| 236 | Number of Distinct Detects                                                                                                               |   |   | 2       |   | Number of Distinct Non-Detects    |   |   | 6      |   |   |
| 237 | Minimum Detect                                                                                                                           |   |   | 0.284   |   | Minimum Non-Detect                |   |   | 0.235  |   |   |
| 238 | Maximum Detect                                                                                                                           |   |   | 0.345   |   | Maximum Non-Detect                |   |   | 0.292  |   |   |
| 239 | Variance Detects                                                                                                                         |   |   | 0.00183 |   | Percent Non-Detects               |   |   | 75%    |   |   |
| 240 | Mean Detects                                                                                                                             |   |   | 0.315   |   | SD Detects                        |   |   | 0.0428 |   |   |
| 241 | Median Detects                                                                                                                           |   |   | 0.315   |   | CV Detects                        |   |   | 0.136  |   |   |
| 242 | Skewness Detects                                                                                                                         |   |   | N/A     |   | Kurtosis Detects                  |   |   | N/A    |   |   |
| 243 | Mean of Logged Detects                                                                                                                   |   |   | -1.161  |   | SD of Logged Detects              |   |   | 0.137  |   |   |
| 244 |                                                                                                                                          |   |   |         |   |                                   |   |   |        |   |   |
| 245 | <b>Warning: Data set has only 2 Detected Values.</b>                                                                                     |   |   |         |   |                                   |   |   |        |   |   |
| 246 | <b>This is not enough to compute meaningful or reliable statistics and estimates.</b>                                                    |   |   |         |   |                                   |   |   |        |   |   |
| 247 |                                                                                                                                          |   |   |         |   |                                   |   |   |        |   |   |
| 248 |                                                                                                                                          |   |   |         |   |                                   |   |   |        |   |   |
| 249 | Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use                                         |   |   |         |   |                                   |   |   |        |   |   |
| 250 | guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.                                          |   |   |         |   |                                   |   |   |        |   |   |
| 251 | For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).                                                             |   |   |         |   |                                   |   |   |        |   |   |
| 252 | Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1                                                  |   |   |         |   |                                   |   |   |        |   |   |
| 253 |                                                                                                                                          |   |   |         |   |                                   |   |   |        |   |   |
| 254 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |   |         |   |                                   |   |   |        |   |   |
| 255 | <b>Not Enough Data to Perform GOF Test</b>                                                                                               |   |   |         |   |                                   |   |   |        |   |   |
| 256 |                                                                                                                                          |   |   |         |   |                                   |   |   |        |   |   |
| 257 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |   |         |   |                                   |   |   |        |   |   |
| 258 | KM Mean                                                                                                                                  |   |   | 0.256   |   | KM Standard Error of Mean         |   |   | 0.0193 |   |   |
| 259 | KM SD                                                                                                                                    |   |   | 0.0379  |   | 95% KM (BCA) UCL                  |   |   | N/A    |   |   |
| 260 | 95% KM (t) UCL                                                                                                                           |   |   | 0.292   |   | 95% KM (Percentile Bootstrap) UCL |   |   | N/A    |   |   |
| 261 | 95% KM (z) UCL                                                                                                                           |   |   | 0.288   |   | 95% KM Bootstrap t UCL            |   |   | N/A    |   |   |
| 262 | 90% KM Chebyshev UCL                                                                                                                     |   |   | 0.314   |   | 95% KM Chebyshev UCL              |   |   | 0.34   |   |   |
| 263 | 97.5% KM Chebyshev UCL                                                                                                                   |   |   | 0.376   |   | 99% KM Chebyshev UCL              |   |   | 0.448  |   |   |
| 264 |                                                                                                                                          |   |   |         |   |                                   |   |   |        |   |   |
| 265 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |   |   |         |   |                                   |   |   |        |   |   |
| 266 | <b>Not Enough Data to Perform GOF Test</b>                                                                                               |   |   |         |   |                                   |   |   |        |   |   |
| 267 |                                                                                                                                          |   |   |         |   |                                   |   |   |        |   |   |
| 268 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |   |   |         |   |                                   |   |   |        |   |   |



| A   | B                                                                                                                          | C      | D                                                               | E | F     | G | H | I | J | K | L |
|-----|----------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------------------|---|-------|---|---|---|---|---|---|
| 336 | The data set for variable Result (deermuscle_mercury) was not processed!                                                   |        |                                                                 |   |       |   |   |   |   |   |   |
| 337 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 338 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 339 | Result (deermuscle_thallium)                                                                                               |        |                                                                 |   |       |   |   |   |   |   |   |
| 340 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 341 | General Statistics                                                                                                         |        |                                                                 |   |       |   |   |   |   |   |   |
| 342 | Total Number of Observations                                                                                               | 8      | Number of Distinct Observations                                 |   | 8     |   |   |   |   |   |   |
| 343 | Number of Detects                                                                                                          | 0      | Number of Non-Detects                                           |   | 8     |   |   |   |   |   |   |
| 344 | Number of Distinct Detects                                                                                                 | 0      | Number of Distinct Non-Detects                                  |   | 8     |   |   |   |   |   |   |
| 345 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 346 | Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!                |        |                                                                 |   |       |   |   |   |   |   |   |
| 347 | Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!          |        |                                                                 |   |       |   |   |   |   |   |   |
| 348 | The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV). |        |                                                                 |   |       |   |   |   |   |   |   |
| 349 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 350 | The data set for variable Result (deermuscle_thallium) was not processed!                                                  |        |                                                                 |   |       |   |   |   |   |   |   |
| 351 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 352 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 353 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 354 | Result (deermuscle_zinc)                                                                                                   |        |                                                                 |   |       |   |   |   |   |   |   |
| 355 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 356 | General Statistics                                                                                                         |        |                                                                 |   |       |   |   |   |   |   |   |
| 357 | Total Number of Observations                                                                                               | 8      | Number of Distinct Observations                                 |   | 8     |   |   |   |   |   |   |
| 358 |                                                                                                                            |        | Number of Missing Observations                                  |   | 0     |   |   |   |   |   |   |
| 359 | Minimum                                                                                                                    | 12.93  | Mean                                                            |   | 30.05 |   |   |   |   |   |   |
| 360 | Maximum                                                                                                                    | 64.64  | Median                                                          |   | 24.85 |   |   |   |   |   |   |
| 361 | SD                                                                                                                         | 16.1   | Std. Error of Mean                                              |   | 5.694 |   |   |   |   |   |   |
| 362 | Coefficient of Variation                                                                                                   | 0.536  | Skewness                                                        |   | 1.653 |   |   |   |   |   |   |
| 363 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 364 | Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use                           |        |                                                                 |   |       |   |   |   |   |   |   |
| 365 | guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 366 | For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).                                               |        |                                                                 |   |       |   |   |   |   |   |   |
| 367 | Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1                                    |        |                                                                 |   |       |   |   |   |   |   |   |
| 368 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 369 | Normal GOF Test                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 370 | Shapiro Wilk Test Statistic                                                                                                | 0.832  | Shapiro Wilk GOF Test                                           |   |       |   |   |   |   |   |   |
| 371 | 5% Shapiro Wilk Critical Value                                                                                             | 0.818  | Data appear Normal at 5% Significance Level                     |   |       |   |   |   |   |   |   |
| 372 | Lilliefors Test Statistic                                                                                                  | 0.291  | Lilliefors GOF Test                                             |   |       |   |   |   |   |   |   |
| 373 | 5% Lilliefors Critical Value                                                                                               | 0.283  | Data Not Normal at 5% Significance Level                        |   |       |   |   |   |   |   |   |
| 374 | Data appear Approximate Normal at 5% Significance Level                                                                    |        |                                                                 |   |       |   |   |   |   |   |   |
| 375 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 376 | Assuming Normal Distribution                                                                                               |        |                                                                 |   |       |   |   |   |   |   |   |
| 377 | 95% Normal UCL                                                                                                             |        | 95% UCLs (Adjusted for Skewness)                                |   |       |   |   |   |   |   |   |
| 378 | 95% Student's-t UCL                                                                                                        | 40.84  | 95% Adjusted-CLT UCL (Chen-1995)                                |   | 42.97 |   |   |   |   |   |   |
| 379 |                                                                                                                            |        | 95% Modified-t UCL (Johnson-1978)                               |   | 41.39 |   |   |   |   |   |   |
| 380 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 381 | Gamma GOF Test                                                                                                             |        |                                                                 |   |       |   |   |   |   |   |   |
| 382 | A-D Test Statistic                                                                                                         | 0.42   | Anderson-Darling Gamma GOF Test                                 |   |       |   |   |   |   |   |   |
| 383 | 5% A-D Critical Value                                                                                                      | 0.719  | Detected data appear Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |   |   |
| 384 | K-S Test Statistic                                                                                                         | 0.239  | Kolmogorov-Smirnov Gamma GOF Test                               |   |       |   |   |   |   |   |   |
| 385 | 5% K-S Critical Value                                                                                                      | 0.295  | Detected data appear Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |   |   |
| 386 | Detected data appear Gamma Distributed at 5% Significance Level                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 387 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 388 | Gamma Statistics                                                                                                           |        |                                                                 |   |       |   |   |   |   |   |   |
| 389 | k hat (MLE)                                                                                                                | 4.871  | k star (bias corrected MLE)                                     |   | 3.128 |   |   |   |   |   |   |
| 390 | Theta hat (MLE)                                                                                                            | 6.169  | Theta star (bias corrected MLE)                                 |   | 9.607 |   |   |   |   |   |   |
| 391 | nu hat (MLE)                                                                                                               | 77.94  | nu star (bias corrected)                                        |   | 50.04 |   |   |   |   |   |   |
| 392 | MLE Mean (bias corrected)                                                                                                  | 30.05  | MLE Sd (bias corrected)                                         |   | 16.99 |   |   |   |   |   |   |
| 393 |                                                                                                                            |        | Approximate Chi Square Value (0.05)                             |   | 34.8  |   |   |   |   |   |   |
| 394 | Adjusted Level of Significance                                                                                             | 0.0195 | Adjusted Chi Square Value                                       |   | 31.62 |   |   |   |   |   |   |
| 395 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 396 | Assuming Gamma Distribution                                                                                                |        |                                                                 |   |       |   |   |   |   |   |   |
| 397 | 95% Approximate Gamma UCL (use when n>=50))                                                                                | 43.21  | 95% Adjusted Gamma UCL (use when n<50)                          |   | 47.56 |   |   |   |   |   |   |
| 398 |                                                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 399 | Lognormal GOF Test                                                                                                         |        |                                                                 |   |       |   |   |   |   |   |   |
| 400 | Shapiro Wilk Test Statistic                                                                                                | 0.948  | Shapiro Wilk Lognormal GOF Test                                 |   |       |   |   |   |   |   |   |
| 401 | 5% Shapiro Wilk Critical Value                                                                                             | 0.818  | Data appear Lognormal at 5% Significance Level                  |   |       |   |   |   |   |   |   |
| 402 | Lilliefors Test Statistic                                                                                                  | 0.209  | Lilliefors Lognormal GOF Test                                   |   |       |   |   |   |   |   |   |

| A   | B                                                                                                                                        | C                            | D     | E                               | F                                              | G | H | I | J | K | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------|---------------------------------|------------------------------------------------|---|---|---|---|---|---|
| 403 |                                                                                                                                          | 5% Lilliefors Critical Value | 0.283 |                                 | Data appear Lognormal at 5% Significance Level |   |   |   |   |   |   |
| 404 | Data appear Lognormal at 5% Significance Level                                                                                           |                              |       |                                 |                                                |   |   |   |   |   |   |
| 405 |                                                                                                                                          |                              |       |                                 |                                                |   |   |   |   |   |   |
| 406 | Lognormal Statistics                                                                                                                     |                              |       |                                 |                                                |   |   |   |   |   |   |
| 407 | Minimum of Logged Data                                                                                                                   | 2.56                         |       | Mean of logged Data             | 3.297                                          |   |   |   |   |   |   |
| 408 | Maximum of Logged Data                                                                                                                   | 4.169                        |       | SD of logged Data               | 0.479                                          |   |   |   |   |   |   |
| 409 |                                                                                                                                          |                              |       |                                 |                                                |   |   |   |   |   |   |
| 410 | Assuming Lognormal Distribution                                                                                                          |                              |       |                                 |                                                |   |   |   |   |   |   |
| 411 | 95% H-UCL                                                                                                                                | 46.1                         |       | 90% Chebyshev (MVUE) UCL        | 45.13                                          |   |   |   |   |   |   |
| 412 | 95% Chebyshev (MVUE) UCL                                                                                                                 | 52.06                        |       | 97.5% Chebyshev (MVUE) UCL      | 61.67                                          |   |   |   |   |   |   |
| 413 | 99% Chebyshev (MVUE) UCL                                                                                                                 | 80.56                        |       |                                 |                                                |   |   |   |   |   |   |
| 414 |                                                                                                                                          |                              |       |                                 |                                                |   |   |   |   |   |   |
| 415 | Nonparametric Distribution Free UCL Statistics                                                                                           |                              |       |                                 |                                                |   |   |   |   |   |   |
| 416 | Data appear to follow a Discernible Distribution at 5% Significance Level                                                                |                              |       |                                 |                                                |   |   |   |   |   |   |
| 417 |                                                                                                                                          |                              |       |                                 |                                                |   |   |   |   |   |   |
| 418 | Nonparametric Distribution Free UCLs                                                                                                     |                              |       |                                 |                                                |   |   |   |   |   |   |
| 419 | 95% CLT UCL                                                                                                                              | 39.41                        |       | 95% Jackknife UCL               | 40.84                                          |   |   |   |   |   |   |
| 420 | 95% Standard Bootstrap UCL                                                                                                               | 38.9                         |       | 95% Bootstrap-t UCL             | 55.33                                          |   |   |   |   |   |   |
| 421 | 95% Hall's Bootstrap UCL                                                                                                                 | 98.73                        |       | 95% Percentile Bootstrap UCL    | 39.67                                          |   |   |   |   |   |   |
| 422 | 95% BCA Bootstrap UCL                                                                                                                    | 43.26                        |       |                                 |                                                |   |   |   |   |   |   |
| 423 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              | 47.13                        |       | 95% Chebyshev(Mean, Sd) UCL     | 54.87                                          |   |   |   |   |   |   |
| 424 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            | 65.61                        |       | 99% Chebyshev(Mean, Sd) UCL     | 86.7                                           |   |   |   |   |   |   |
| 425 |                                                                                                                                          |                              |       |                                 |                                                |   |   |   |   |   |   |
| 426 | Suggested UCL to Use                                                                                                                     |                              |       |                                 |                                                |   |   |   |   |   |   |
| 427 | 95% Student's-t UCL                                                                                                                      | 40.84                        |       |                                 |                                                |   |   |   |   |   |   |
| 428 |                                                                                                                                          |                              |       |                                 |                                                |   |   |   |   |   |   |
| 429 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                           |                              |       |                                 |                                                |   |   |   |   |   |   |
| 430 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                   |                              |       |                                 |                                                |   |   |   |   |   |   |
| 431 |                                                                                                                                          |                              |       |                                 |                                                |   |   |   |   |   |   |
| 432 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |                              |       |                                 |                                                |   |   |   |   |   |   |
| 433 | Recommendations are based upon data size, data distribution, and skewness.                                                               |                              |       |                                 |                                                |   |   |   |   |   |   |
| 434 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |                              |       |                                 |                                                |   |   |   |   |   |   |
| 435 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |                              |       |                                 |                                                |   |   |   |   |   |   |
| 436 |                                                                                                                                          |                              |       |                                 |                                                |   |   |   |   |   |   |
| 437 | Result (deerorgan_antimony)                                                                                                              |                              |       |                                 |                                                |   |   |   |   |   |   |
| 438 |                                                                                                                                          |                              |       |                                 |                                                |   |   |   |   |   |   |
| 439 | General Statistics                                                                                                                       |                              |       |                                 |                                                |   |   |   |   |   |   |
| 440 | Total Number of Observations                                                                                                             | 8                            |       | Number of Distinct Observations | 8                                              |   |   |   |   |   |   |
| 441 | Number of Detects                                                                                                                        | 0                            |       | Number of Non-Detects           | 8                                              |   |   |   |   |   |   |
| 442 | Number of Distinct Detects                                                                                                               | 0                            |       | Number of Distinct Non-Detects  | 8                                              |   |   |   |   |   |   |
| 443 |                                                                                                                                          |                              |       |                                 |                                                |   |   |   |   |   |   |
| 444 | Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!                              |                              |       |                                 |                                                |   |   |   |   |   |   |
| 445 | Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!                        |                              |       |                                 |                                                |   |   |   |   |   |   |
| 446 | The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).               |                              |       |                                 |                                                |   |   |   |   |   |   |
| 447 |                                                                                                                                          |                              |       |                                 |                                                |   |   |   |   |   |   |
| 448 | The data set for variable Result (deerorgan_antimony) was not processed!                                                                 |                              |       |                                 |                                                |   |   |   |   |   |   |
| 449 |                                                                                                                                          |                              |       |                                 |                                                |   |   |   |   |   |   |
| 450 |                                                                                                                                          |                              |       |                                 |                                                |   |   |   |   |   |   |
| 451 | Result (deerorgan_arsenic)                                                                                                               |                              |       |                                 |                                                |   |   |   |   |   |   |
| 452 |                                                                                                                                          |                              |       |                                 |                                                |   |   |   |   |   |   |
| 453 | General Statistics                                                                                                                       |                              |       |                                 |                                                |   |   |   |   |   |   |
| 454 | Total Number of Observations                                                                                                             | 8                            |       | Number of Distinct Observations | 8                                              |   |   |   |   |   |   |
| 455 | Number of Detects                                                                                                                        | 0                            |       | Number of Non-Detects           | 8                                              |   |   |   |   |   |   |
| 456 | Number of Distinct Detects                                                                                                               | 0                            |       | Number of Distinct Non-Detects  | 8                                              |   |   |   |   |   |   |
| 457 |                                                                                                                                          |                              |       |                                 |                                                |   |   |   |   |   |   |
| 458 | Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!                              |                              |       |                                 |                                                |   |   |   |   |   |   |
| 459 | Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!                        |                              |       |                                 |                                                |   |   |   |   |   |   |
| 460 | The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).               |                              |       |                                 |                                                |   |   |   |   |   |   |
| 461 |                                                                                                                                          |                              |       |                                 |                                                |   |   |   |   |   |   |
| 462 | The data set for variable Result (deerorgan_arsenic) was not processed!                                                                  |                              |       |                                 |                                                |   |   |   |   |   |   |
| 463 |                                                                                                                                          |                              |       |                                 |                                                |   |   |   |   |   |   |
| 464 |                                                                                                                                          |                              |       |                                 |                                                |   |   |   |   |   |   |
| 465 | Result (deerorgan_cadmium)                                                                                                               |                              |       |                                 |                                                |   |   |   |   |   |   |
| 466 |                                                                                                                                          |                              |       |                                 |                                                |   |   |   |   |   |   |
| 467 | General Statistics                                                                                                                       |                              |       |                                 |                                                |   |   |   |   |   |   |
| 468 | Total Number of Observations                                                                                                             | 8                            |       | Number of Distinct Observations | 8                                              |   |   |   |   |   |   |
| 469 | Number of Detects                                                                                                                        | 4                            |       | Number of Non-Detects           | 4                                              |   |   |   |   |   |   |

|     | A                                                                                                                         | B | C | D | E      | F                                                             | G | H | I | J      | K | L |  |  |
|-----|---------------------------------------------------------------------------------------------------------------------------|---|---|---|--------|---------------------------------------------------------------|---|---|---|--------|---|---|--|--|
| 470 | Number of Distinct Detects                                                                                                |   |   |   | 4      | Number of Distinct Non-Detects                                |   |   |   | 4      |   |   |  |  |
| 471 | Minimum Detect                                                                                                            |   |   |   | 0.0604 | Minimum Non-Detect                                            |   |   |   | 0.0118 |   |   |  |  |
| 472 | Maximum Detect                                                                                                            |   |   |   | 1.954  | Maximum Non-Detect                                            |   |   |   | 0.0418 |   |   |  |  |
| 473 | Variance Detects                                                                                                          |   |   |   | 0.809  | Percent Non-Detects                                           |   |   |   | 50%    |   |   |  |  |
| 474 | Mean Detects                                                                                                              |   |   |   | 0.613  | SD Detects                                                    |   |   |   | 0.9    |   |   |  |  |
| 475 | Median Detects                                                                                                            |   |   |   | 0.219  | CV Detects                                                    |   |   |   | 1.467  |   |   |  |  |
| 476 | Skewness Detects                                                                                                          |   |   |   | 1.925  | Kurtosis Detects                                              |   |   |   | 3.736  |   |   |  |  |
| 477 | Mean of Logged Detects                                                                                                    |   |   |   | -1.333 | SD of Logged Detects                                          |   |   |   | 1.489  |   |   |  |  |
| 478 |                                                                                                                           |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 479 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 480 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                    |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 481 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                       |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 482 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                            |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 483 |                                                                                                                           |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 484 | <b>Normal GOF Test on Detects Only</b>                                                                                    |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 485 | Shapiro Wilk Test Statistic                                                                                               |   |   |   | 0.728  | <b>Shapiro Wilk GOF Test</b>                                  |   |   |   |        |   |   |  |  |
| 486 | 5% Shapiro Wilk Critical Value                                                                                            |   |   |   | 0.748  | Detected Data Not Normal at 5% Significance Level             |   |   |   |        |   |   |  |  |
| 487 | Lilliefors Test Statistic                                                                                                 |   |   |   | 0.385  | <b>Lilliefors GOF Test</b>                                    |   |   |   |        |   |   |  |  |
| 488 | 5% Lilliefors Critical Value                                                                                              |   |   |   | 0.375  | Detected Data Not Normal at 5% Significance Level             |   |   |   |        |   |   |  |  |
| 489 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                  |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 490 |                                                                                                                           |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 491 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 492 | KM Mean                                                                                                                   |   |   |   | 0.312  | KM Standard Error of Mean                                     |   |   |   | 0.256  |   |   |  |  |
| 493 | KM SD                                                                                                                     |   |   |   | 0.628  | 95% KM (BCA) UCL                                              |   |   |   | N/A    |   |   |  |  |
| 494 | 95% KM (t) UCL                                                                                                            |   |   |   | 0.798  | 95% KM (Percentile Bootstrap) UCL                             |   |   |   | N/A    |   |   |  |  |
| 495 | 95% KM (z) UCL                                                                                                            |   |   |   | 0.734  | 95% KM Bootstrap t UCL                                        |   |   |   | N/A    |   |   |  |  |
| 496 | 90% KM Chebyshev UCL                                                                                                      |   |   |   | 1.081  | 95% KM Chebyshev UCL                                          |   |   |   | 1.429  |   |   |  |  |
| 497 | 97.5% KM Chebyshev UCL                                                                                                    |   |   |   | 1.913  | 99% KM Chebyshev UCL                                          |   |   |   | 2.862  |   |   |  |  |
| 498 |                                                                                                                           |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 499 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 500 | A-D Test Statistic                                                                                                        |   |   |   | 0.393  | <b>Anderson-Darling GOF Test</b>                              |   |   |   |        |   |   |  |  |
| 501 | 5% A-D Critical Value                                                                                                     |   |   |   | 0.672  | detected data appear Gamma Distributed at 5% Significance Lev |   |   |   |        |   |   |  |  |
| 502 | K-S Test Statistic                                                                                                        |   |   |   | 0.297  | <b>Kolmogorov-Smirnov GOF</b>                                 |   |   |   |        |   |   |  |  |
| 503 | 5% K-S Critical Value                                                                                                     |   |   |   | 0.406  | detected data appear Gamma Distributed at 5% Significance Lev |   |   |   |        |   |   |  |  |
| 504 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                    |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 505 |                                                                                                                           |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 506 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 507 | k hat (MLE)                                                                                                               |   |   |   | 0.714  | k star (bias corrected MLE)                                   |   |   |   | 0.345  |   |   |  |  |
| 508 | Theta hat (MLE)                                                                                                           |   |   |   | 0.858  | Theta star (bias corrected MLE)                               |   |   |   | 1.776  |   |   |  |  |
| 509 | nu hat (MLE)                                                                                                              |   |   |   | 5.714  | nu star (bias corrected)                                      |   |   |   | 2.762  |   |   |  |  |
| 510 | Mean (detects)                                                                                                            |   |   |   | 0.613  |                                                               |   |   |   |        |   |   |  |  |
| 511 |                                                                                                                           |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 512 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 513 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 514 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 515 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 516 | This is especially true when the sample size is small.                                                                    |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 517 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 518 | Minimum                                                                                                                   |   |   |   | 0.01   | Mean                                                          |   |   |   | 0.312  |   |   |  |  |
| 519 | Maximum                                                                                                                   |   |   |   | 1.954  | Median                                                        |   |   |   | 0.0352 |   |   |  |  |
| 520 | SD                                                                                                                        |   |   |   | 0.671  | CV                                                            |   |   |   | 2.155  |   |   |  |  |
| 521 | k hat (MLE)                                                                                                               |   |   |   | 0.37   | k star (bias corrected MLE)                                   |   |   |   | 0.314  |   |   |  |  |
| 522 | Theta hat (MLE)                                                                                                           |   |   |   | 0.843  | Theta star (bias corrected MLE)                               |   |   |   | 0.991  |   |   |  |  |
| 523 | nu hat (MLE)                                                                                                              |   |   |   | 5.915  | nu star (bias corrected)                                      |   |   |   | 5.03   |   |   |  |  |
| 524 | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   |   | 0.0195 |                                                               |   |   |   |        |   |   |  |  |
| 525 | Approximate Chi Square Value (5.03, $\alpha$ )                                                                            |   |   |   | 1.166  | Adjusted Chi Square Value (5.03, $\beta$ )                    |   |   |   | 0.765  |   |   |  |  |
| 526 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   |   | 1.344  | 95% Gamma Adjusted UCL (use when $n < 50$ )                   |   |   |   | N/A    |   |   |  |  |
| 527 |                                                                                                                           |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 528 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |
| 529 | Mean (KM)                                                                                                                 |   |   |   | 0.312  | SD (KM)                                                       |   |   |   | 0.628  |   |   |  |  |
| 530 | Variance (KM)                                                                                                             |   |   |   | 0.394  | SE of Mean (KM)                                               |   |   |   | 0.256  |   |   |  |  |
| 531 | k hat (KM)                                                                                                                |   |   |   | 0.248  | k star (KM)                                                   |   |   |   | 0.238  |   |   |  |  |
| 532 | nu hat (KM)                                                                                                               |   |   |   | 3.967  | nu star (KM)                                                  |   |   |   | 3.812  |   |   |  |  |
| 533 | theta hat (KM)                                                                                                            |   |   |   | 1.26   | theta star (KM)                                               |   |   |   | 1.311  |   |   |  |  |
| 534 | 80% gamma percentile (KM)                                                                                                 |   |   |   | 0.446  | 90% gamma percentile (KM)                                     |   |   |   | 0.941  |   |   |  |  |
| 535 | 95% gamma percentile (KM)                                                                                                 |   |   |   | 1.534  | 99% gamma percentile (KM)                                     |   |   |   | 3.124  |   |   |  |  |
| 536 |                                                                                                                           |   |   |   |        |                                                               |   |   |   |        |   |   |  |  |

| A   | B                                                                                                                                        | C | D | E      | F                                                                | G                           | H | I      | J | K | L |  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|------------------------------------------------------------------|-----------------------------|---|--------|---|---|---|--|
| 537 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 538 | Approximate Chi Square Value (3.81, $\alpha$ )                                                                                           |   |   | 0.649  | Adjusted Chi Square Value (3.81, $\beta$ )                       |                             |   | 0.392  |   |   |   |  |
| 539 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                      |   |   | 1.836  | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )                   |                             |   | 3.039  |   |   |   |  |
| 540 |                                                                                                                                          |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 541 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 542 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.959  | <b>Shapiro Wilk GOF Test</b>                                     |                             |   |        |   |   |   |  |
| 543 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.748  | Detected Data appear Lognormal at 5% Significance Level          |                             |   |        |   |   |   |  |
| 544 | Lilliefors Test Statistic                                                                                                                |   |   | 0.213  | <b>Lilliefors GOF Test</b>                                       |                             |   |        |   |   |   |  |
| 545 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.375  | Detected Data appear Lognormal at 5% Significance Level          |                             |   |        |   |   |   |  |
| 546 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                           |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 547 |                                                                                                                                          |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 548 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 549 | Mean in Original Scale                                                                                                                   |   |   | 0.308  | Mean in Log Scale                                                |                             |   | -3.674 |   |   |   |  |
| 550 | SD in Original Scale                                                                                                                     |   |   | 0.673  | SD in Log Scale                                                  |                             |   | 2.685  |   |   |   |  |
| 551 | 95% t UCL (assumes normality of ROS data)                                                                                                |   |   | 0.759  | 95% Percentile Bootstrap UCL                                     |                             |   | 0.751  |   |   |   |  |
| 552 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 0.995  | 95% Bootstrap t UCL                                              |                             |   | 4.097  |   |   |   |  |
| 553 | 95% H-UCL (Log ROS)                                                                                                                      |   |   | 3461   |                                                                  |                             |   |        |   |   |   |  |
| 554 |                                                                                                                                          |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 555 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 556 | KM Mean (logged)                                                                                                                         |   |   | -2.886 | KM Geo Mean                                                      |                             |   | 0.0558 |   |   |   |  |
| 557 | KM SD (logged)                                                                                                                           |   |   | 1.801  | 95% Critical H Value (KM-Log)                                    |                             |   | 5.573  |   |   |   |  |
| 558 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.735  | 95% H-UCL (KM -Log)                                              |                             |   | 12.53  |   |   |   |  |
| 559 | KM SD (logged)                                                                                                                           |   |   | 1.801  | 95% Critical H Value (KM-Log)                                    |                             |   | 5.573  |   |   |   |  |
| 560 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.735  |                                                                  |                             |   |        |   |   |   |  |
| 561 |                                                                                                                                          |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 562 | <b>DL/2 Statistics</b>                                                                                                                   |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 563 | <b>DL/2 Normal</b>                                                                                                                       |   |   |        |                                                                  | <b>DL/2 Log-Transformed</b> |   |        |   |   |   |  |
| 564 | Mean in Original Scale                                                                                                                   |   |   | 0.313  | Mean in Log Scale                                                |                             |   | -2.934 |   |   |   |  |
| 565 | SD in Original Scale                                                                                                                     |   |   | 0.671  | SD in Log Scale                                                  |                             |   | 2.019  |   |   |   |  |
| 566 | 95% t UCL (Assumes normality)                                                                                                            |   |   | 0.762  | 95% H-Stat UCL                                                   |                             |   | 45.88  |   |   |   |  |
| 567 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 568 |                                                                                                                                          |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 569 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 570 | <b>Detected Data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 571 |                                                                                                                                          |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 572 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 573 | 95% KM Bootstrap t UCL                                                                                                                   |   |   | N/A    | d KM-UCL (use when $k \leq 1$ and $15 < n < 50$ but $k \leq 1$ ) |                             |   | 3.039  |   |   |   |  |
| 574 |                                                                                                                                          |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 575 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 576 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 577 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 578 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 579 |                                                                                                                                          |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 580 | <b>Result (deerorgan_chromium)</b>                                                                                                       |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 581 |                                                                                                                                          |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 582 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 583 | Total Number of Observations                                                                                                             |   |   | 8      | Number of Distinct Observations                                  |                             |   | 8      |   |   |   |  |
| 584 | Number of Detects                                                                                                                        |   |   | 7      | Number of Non-Detects                                            |                             |   | 1      |   |   |   |  |
| 585 | Number of Distinct Detects                                                                                                               |   |   | 7      | Number of Distinct Non-Detects                                   |                             |   | 1      |   |   |   |  |
| 586 | Minimum Detect                                                                                                                           |   |   | 0.446  | Minimum Non-Detect                                               |                             |   | 0.418  |   |   |   |  |
| 587 | Maximum Detect                                                                                                                           |   |   | 0.967  | Maximum Non-Detect                                               |                             |   | 0.418  |   |   |   |  |
| 588 | Variance Detects                                                                                                                         |   |   | 0.0398 | Percent Non-Detects                                              |                             |   | 12.5%  |   |   |   |  |
| 589 | Mean Detects                                                                                                                             |   |   | 0.656  | SD Detects                                                       |                             |   | 0.199  |   |   |   |  |
| 590 | Median Detects                                                                                                                           |   |   | 0.602  | CV Detects                                                       |                             |   | 0.304  |   |   |   |  |
| 591 | Skewness Detects                                                                                                                         |   |   | 0.842  | Kurtosis Detects                                                 |                             |   | -0.864 |   |   |   |  |
| 592 | Mean of Logged Detects                                                                                                                   |   |   | -0.459 | SD of Logged Detects                                             |                             |   | 0.291  |   |   |   |  |
| 593 |                                                                                                                                          |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 594 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 595 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 596 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 597 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 598 |                                                                                                                                          |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 599 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |   |        |                                                                  |                             |   |        |   |   |   |  |
| 600 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.883  | <b>Shapiro Wilk GOF Test</b>                                     |                             |   |        |   |   |   |  |
| 601 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.803  | Detected Data appear Normal at 5% Significance Level             |                             |   |        |   |   |   |  |
| 602 | Lilliefors Test Statistic                                                                                                                |   |   | 0.247  | <b>Lilliefors GOF Test</b>                                       |                             |   |        |   |   |   |  |
| 603 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.304  | Detected Data appear Normal at 5% Significance Level             |                             |   |        |   |   |   |  |

|     | A                                                                                                                         | B                                                   | C      | D | E | F                                                               | G | H | I | J | K      | L |
|-----|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|--------|---|---|-----------------------------------------------------------------|---|---|---|---|--------|---|
| 604 | <b>Detected Data appear Normal at 5% Significance Level</b>                                                               |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 605 |                                                                                                                           |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 606 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 607 |                                                                                                                           | KM Mean                                             | 0.626  |   |   | KM Standard Error of Mean                                       |   |   |   |   | 0.0724 |   |
| 608 |                                                                                                                           | KM SD                                               | 0.19   |   |   | 95% KM (BCA) UCL                                                |   |   |   |   | 0.751  |   |
| 609 |                                                                                                                           | 95% KM (t) UCL                                      | 0.763  |   |   | 95% KM (Percentile Bootstrap) UCL                               |   |   |   |   | 0.744  |   |
| 610 |                                                                                                                           | 95% KM (z) UCL                                      | 0.745  |   |   | 95% KM Bootstrap t UCL                                          |   |   |   |   | 0.858  |   |
| 611 |                                                                                                                           | 90% KM Chebyshev UCL                                | 0.843  |   |   | 95% KM Chebyshev UCL                                            |   |   |   |   | 0.942  |   |
| 612 |                                                                                                                           | 97.5% KM Chebyshev UCL                              | 1.079  |   |   | 99% KM Chebyshev UCL                                            |   |   |   |   | 1.347  |   |
| 613 |                                                                                                                           |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 614 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 615 |                                                                                                                           | A-D Test Statistic                                  | 0.379  |   |   | <b>Anderson-Darling GOF Test</b>                                |   |   |   |   |        |   |
| 616 |                                                                                                                           | 5% A-D Critical Value                               | 0.708  |   |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |   |        |   |
| 617 |                                                                                                                           | K-S Test Statistic                                  | 0.215  |   |   | <b>Kolmogorov-Smirnov GOF</b>                                   |   |   |   |   |        |   |
| 618 |                                                                                                                           | 5% K-S Critical Value                               | 0.312  |   |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |   |        |   |
| 619 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                    |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 620 |                                                                                                                           |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 621 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 622 |                                                                                                                           | k hat (MLE)                                         | 13.57  |   |   | k star (bias corrected MLE)                                     |   |   |   |   | 7.85   |   |
| 623 |                                                                                                                           | Theta hat (MLE)                                     | 0.0483 |   |   | Theta star (bias corrected MLE)                                 |   |   |   |   | 0.0835 |   |
| 624 |                                                                                                                           | nu hat (MLE)                                        | 190    |   |   | nu star (bias corrected)                                        |   |   |   |   | 109.9  |   |
| 625 |                                                                                                                           | Mean (detects)                                      | 0.656  |   |   |                                                                 |   |   |   |   |        |   |
| 626 |                                                                                                                           |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 627 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 628 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 629 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 630 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 631 | This is especially true when the sample size is small.                                                                    |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 632 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 633 |                                                                                                                           | Minimum                                             | 0.233  |   |   | Mean                                                            |   |   |   |   | 0.603  |   |
| 634 |                                                                                                                           | Maximum                                             | 0.967  |   |   | Median                                                          |   |   |   |   | 0.576  |   |
| 635 |                                                                                                                           | SD                                                  | 0.238  |   |   | CV                                                              |   |   |   |   | 0.394  |   |
| 636 |                                                                                                                           | k hat (MLE)                                         | 6.566  |   |   | k star (bias corrected MLE)                                     |   |   |   |   | 4.187  |   |
| 637 |                                                                                                                           | Theta hat (MLE)                                     | 0.0918 |   |   | Theta star (bias corrected MLE)                                 |   |   |   |   | 0.144  |   |
| 638 |                                                                                                                           | nu hat (MLE)                                        | 105.1  |   |   | nu star (bias corrected)                                        |   |   |   |   | 67     |   |
| 639 |                                                                                                                           | Adjusted Level of Significance ( $\beta$ )          | 0.0195 |   |   |                                                                 |   |   |   |   |        |   |
| 640 |                                                                                                                           | Approximate Chi Square Value (67.00, $\alpha$ )     | 49.16  |   |   | Adjusted Chi Square Value (67.00, $\beta$ )                     |   |   |   |   | 45.32  |   |
| 641 |                                                                                                                           | 95% Gamma Approximate UCL (use when $n \geq 50$ )   | 0.822  |   |   | 95% Gamma Adjusted UCL (use when $n < 50$ )                     |   |   |   |   | 0.891  |   |
| 642 |                                                                                                                           |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 643 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 644 |                                                                                                                           | Mean (KM)                                           | 0.626  |   |   | SD (KM)                                                         |   |   |   |   | 0.19   |   |
| 645 |                                                                                                                           | Variance (KM)                                       | 0.036  |   |   | SE of Mean (KM)                                                 |   |   |   |   | 0.0724 |   |
| 646 |                                                                                                                           | k hat (KM)                                          | 10.89  |   |   | k star (KM)                                                     |   |   |   |   | 6.889  |   |
| 647 |                                                                                                                           | nu hat (KM)                                         | 174.2  |   |   | nu star (KM)                                                    |   |   |   |   | 110.2  |   |
| 648 |                                                                                                                           | theta hat (KM)                                      | 0.0575 |   |   | theta star (KM)                                                 |   |   |   |   | 0.0909 |   |
| 649 |                                                                                                                           | 80% gamma percentile (KM)                           | 0.813  |   |   | 90% gamma percentile (KM)                                       |   |   |   |   | 0.945  |   |
| 650 |                                                                                                                           | 95% gamma percentile (KM)                           | 1.063  |   |   | 99% gamma percentile (KM)                                       |   |   |   |   | 1.31   |   |
| 651 |                                                                                                                           |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 652 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 653 |                                                                                                                           | Approximate Chi Square Value (110.23, $\alpha$ )    | 87     |   |   | Adjusted Chi Square Value (110.23, $\beta$ )                    |   |   |   |   | 81.79  |   |
| 654 |                                                                                                                           | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ ) | 0.793  |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )                  |   |   |   |   | 0.844  |   |
| 655 |                                                                                                                           |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 656 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 657 |                                                                                                                           | Shapiro Wilk Test Statistic                         | 0.924  |   |   | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |   |        |   |
| 658 |                                                                                                                           | 5% Shapiro Wilk Critical Value                      | 0.803  |   |   | Detected Data appear Lognormal at 5% Significance Level         |   |   |   |   |        |   |
| 659 |                                                                                                                           | Lilliefors Test Statistic                           | 0.198  |   |   | <b>Lilliefors GOF Test</b>                                      |   |   |   |   |        |   |
| 660 |                                                                                                                           | 5% Lilliefors Critical Value                        | 0.304  |   |   | Detected Data appear Lognormal at 5% Significance Level         |   |   |   |   |        |   |
| 661 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                            |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 662 |                                                                                                                           |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 663 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 664 |                                                                                                                           | Mean in Original Scale                              | 0.612  |   |   | Mean in Log Scale                                               |   |   |   |   | -0.55  |   |
| 665 |                                                                                                                           | SD in Original Scale                                | 0.222  |   |   | SD in Log Scale                                                 |   |   |   |   | 0.371  |   |
| 666 |                                                                                                                           | 95% t UCL (assumes normality of ROS data)           | 0.761  |   |   | 95% Percentile Bootstrap UCL                                    |   |   |   |   | 0.742  |   |
| 667 |                                                                                                                           | 95% BCA Bootstrap UCL                               | 0.745  |   |   | 95% Bootstrap t UCL                                             |   |   |   |   | 0.816  |   |
| 668 |                                                                                                                           | 95% H-UCL (Log ROS)                                 | 0.836  |   |   |                                                                 |   |   |   |   |        |   |
| 669 |                                                                                                                           |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 670 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |

| A   | B | C | D                                                                                                                                        | E | F         | G | H                           | I | J                                                               | K | L       |
|-----|---|---|------------------------------------------------------------------------------------------------------------------------------------------|---|-----------|---|-----------------------------|---|-----------------------------------------------------------------|---|---------|
| 671 |   |   | KM Mean (logged)                                                                                                                         |   | -0.511    |   |                             |   | KM Geo Mean                                                     |   | 0.6     |
| 672 |   |   | KM SD (logged)                                                                                                                           |   | 0.286     |   |                             |   | 95% Critical H Value (KM-Log)                                   |   | 2.041   |
| 673 |   |   | KM Standard Error of Mean (logged)                                                                                                       |   | 0.109     |   |                             |   | 95% H-UCL (KM -Log)                                             |   | 0.78    |
| 674 |   |   | KM SD (logged)                                                                                                                           |   | 0.286     |   |                             |   | 95% Critical H Value (KM-Log)                                   |   | 2.041   |
| 675 |   |   | KM Standard Error of Mean (logged)                                                                                                       |   | 0.109     |   |                             |   |                                                                 |   |         |
| 676 |   |   |                                                                                                                                          |   |           |   |                             |   |                                                                 |   |         |
| 677 |   |   | <b>DL/2 Statistics</b>                                                                                                                   |   |           |   |                             |   |                                                                 |   |         |
| 678 |   |   | <b>DL/2 Normal</b>                                                                                                                       |   |           |   | <b>DL/2 Log-Transformed</b> |   |                                                                 |   |         |
| 679 |   |   | Mean in Original Scale                                                                                                                   |   | 0.6       |   |                             |   | Mean in Log Scale                                               |   | -0.597  |
| 680 |   |   | SD in Original Scale                                                                                                                     |   | 0.243     |   |                             |   | SD in Log Scale                                                 |   | 0.475   |
| 681 |   |   | 95% t UCL (Assumes normality)                                                                                                            |   | 0.763     |   |                             |   | 95% H-Stat UCL                                                  |   | 0.932   |
| 682 |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |           |   |                             |   |                                                                 |   |         |
| 683 |   |   |                                                                                                                                          |   |           |   |                             |   |                                                                 |   |         |
| 684 |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |           |   |                             |   |                                                                 |   |         |
| 685 |   |   | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                  |   |           |   |                             |   |                                                                 |   |         |
| 686 |   |   |                                                                                                                                          |   |           |   |                             |   |                                                                 |   |         |
| 687 |   |   | <b>Suggested UCL to Use</b>                                                                                                              |   |           |   |                             |   |                                                                 |   |         |
| 688 |   |   | 95% KM (t) UCL                                                                                                                           |   | 0.763     |   |                             |   |                                                                 |   |         |
| 689 |   |   |                                                                                                                                          |   |           |   |                             |   |                                                                 |   |         |
| 690 |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |           |   |                             |   |                                                                 |   |         |
| 691 |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |           |   |                             |   |                                                                 |   |         |
| 692 |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |           |   |                             |   |                                                                 |   |         |
| 693 |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |           |   |                             |   |                                                                 |   |         |
| 694 |   |   |                                                                                                                                          |   |           |   |                             |   |                                                                 |   |         |
| 695 |   |   | <b>Result (deerorgan_cobalt)</b>                                                                                                         |   |           |   |                             |   |                                                                 |   |         |
| 696 |   |   |                                                                                                                                          |   |           |   |                             |   |                                                                 |   |         |
| 697 |   |   | <b>General Statistics</b>                                                                                                                |   |           |   |                             |   |                                                                 |   |         |
| 698 |   |   | Total Number of Observations                                                                                                             |   | 8         |   |                             |   | Number of Distinct Observations                                 |   | 8       |
| 699 |   |   | Number of Detects                                                                                                                        |   | 4         |   |                             |   | Number of Non-Detects                                           |   | 4       |
| 700 |   |   | Number of Distinct Detects                                                                                                               |   | 4         |   |                             |   | Number of Distinct Non-Detects                                  |   | 4       |
| 701 |   |   | Minimum Detect                                                                                                                           |   | 0.0115    |   |                             |   | Minimum Non-Detect                                              |   | 0.0118  |
| 702 |   |   | Maximum Detect                                                                                                                           |   | 0.0509    |   |                             |   | Maximum Non-Detect                                              |   | 0.0418  |
| 703 |   |   | Variance Detects                                                                                                                         |   | 3.2798E-4 |   |                             |   | Percent Non-Detects                                             |   | 50%     |
| 704 |   |   | Mean Detects                                                                                                                             |   | 0.0307    |   |                             |   | SD Detects                                                      |   | 0.0181  |
| 705 |   |   | Median Detects                                                                                                                           |   | 0.0303    |   |                             |   | CV Detects                                                      |   | 0.589   |
| 706 |   |   | Skewness Detects                                                                                                                         |   | 0.0924    |   |                             |   | Kurtosis Detects                                                |   | -3.468  |
| 707 |   |   | Mean of Logged Detects                                                                                                                   |   | -3.639    |   |                             |   | SD of Logged Detects                                            |   | 0.677   |
| 708 |   |   |                                                                                                                                          |   |           |   |                             |   |                                                                 |   |         |
| 709 |   |   | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |   |           |   |                             |   |                                                                 |   |         |
| 710 |   |   | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |   |           |   |                             |   |                                                                 |   |         |
| 711 |   |   | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |   |           |   |                             |   |                                                                 |   |         |
| 712 |   |   | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |   |           |   |                             |   |                                                                 |   |         |
| 713 |   |   |                                                                                                                                          |   |           |   |                             |   |                                                                 |   |         |
| 714 |   |   | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |           |   |                             |   |                                                                 |   |         |
| 715 |   |   | Shapiro Wilk Test Statistic                                                                                                              |   | 0.944     |   |                             |   | <b>Shapiro Wilk GOF Test</b>                                    |   |         |
| 716 |   |   | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.748     |   |                             |   | Detected Data appear Normal at 5% Significance Level            |   |         |
| 717 |   |   | Lilliefors Test Statistic                                                                                                                |   | 0.222     |   |                             |   | <b>Lilliefors GOF Test</b>                                      |   |         |
| 718 |   |   | 5% Lilliefors Critical Value                                                                                                             |   | 0.375     |   |                             |   | Detected Data appear Normal at 5% Significance Level            |   |         |
| 719 |   |   | <b>Detected Data appear Normal at 5% Significance Level</b>                                                                              |   |           |   |                             |   |                                                                 |   |         |
| 720 |   |   |                                                                                                                                          |   |           |   |                             |   |                                                                 |   |         |
| 721 |   |   | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |           |   |                             |   |                                                                 |   |         |
| 722 |   |   | KM Mean                                                                                                                                  |   | 0.0222    |   |                             |   | KM Standard Error of Mean                                       |   | 0.00624 |
| 723 |   |   | KM SD                                                                                                                                    |   | 0.0147    |   |                             |   | 95% KM (BCA) UCL                                                |   | N/A     |
| 724 |   |   | 95% KM (t) UCL                                                                                                                           |   | 0.034     |   |                             |   | 95% KM (Percentile Bootstrap) UCL                               |   | N/A     |
| 725 |   |   | 95% KM (z) UCL                                                                                                                           |   | 0.0325    |   |                             |   | 95% KM Bootstrap t UCL                                          |   | N/A     |
| 726 |   |   | 90% KM Chebyshev UCL                                                                                                                     |   | 0.0409    |   |                             |   | 95% KM Chebyshev UCL                                            |   | 0.0494  |
| 727 |   |   | 97.5% KM Chebyshev UCL                                                                                                                   |   | 0.0612    |   |                             |   | 99% KM Chebyshev UCL                                            |   | 0.0843  |
| 728 |   |   |                                                                                                                                          |   |           |   |                             |   |                                                                 |   |         |
| 729 |   |   | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |   |           |   |                             |   |                                                                 |   |         |
| 730 |   |   | A-D Test Statistic                                                                                                                       |   | 0.287     |   |                             |   | <b>Anderson-Darling GOF Test</b>                                |   |         |
| 731 |   |   | 5% A-D Critical Value                                                                                                                    |   | 0.659     |   |                             |   | Detected data appear Gamma Distributed at 5% Significance Level |   |         |
| 732 |   |   | K-S Test Statistic                                                                                                                       |   | 0.259     |   |                             |   | <b>Kolmogorov-Smimov GOF</b>                                    |   |         |
| 733 |   |   | 5% K-S Critical Value                                                                                                                    |   | 0.396     |   |                             |   | Detected data appear Gamma Distributed at 5% Significance Level |   |         |
| 734 |   |   | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |           |   |                             |   |                                                                 |   |         |
| 735 |   |   |                                                                                                                                          |   |           |   |                             |   |                                                                 |   |         |
| 736 |   |   | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |   |           |   |                             |   |                                                                 |   |         |
| 737 |   |   | k hat (MLE)                                                                                                                              |   | 3.341     |   |                             |   | k star (bias corrected MLE)                                     |   | 1.002   |



| A   | B                                                                                                                                        | C      | D                                                               | E | F     | G | H | I | J | K | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------------------|---|-------|---|---|---|---|---|---|
| 805 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |                                                                 |   |       |   |   |   |   |   |   |
| 806 | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |                                                                 |   |       |   |   |   |   |   |   |
| 807 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |                                                                 |   |       |   |   |   |   |   |   |
| 808 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |                                                                 |   |       |   |   |   |   |   |   |
| 809 |                                                                                                                                          |        |                                                                 |   |       |   |   |   |   |   |   |
| 810 | <b>Result (deerorgan_iron)</b>                                                                                                           |        |                                                                 |   |       |   |   |   |   |   |   |
| 811 |                                                                                                                                          |        |                                                                 |   |       |   |   |   |   |   |   |
| 812 | <b>General Statistics</b>                                                                                                                |        |                                                                 |   |       |   |   |   |   |   |   |
| 813 | Total Number of Observations                                                                                                             | 8      | Number of Distinct Observations                                 |   | 8     |   |   |   |   |   |   |
| 814 | Number of Detects                                                                                                                        | 7      | Number of Non-Detects                                           |   | 1     |   |   |   |   |   |   |
| 815 | Number of Distinct Detects                                                                                                               | 7      | Number of Distinct Non-Detects                                  |   | 1     |   |   |   |   |   |   |
| 816 | Minimum Detect                                                                                                                           | 28.06  | Minimum Non-Detect                                              |   | 41.81 |   |   |   |   |   |   |
| 817 | Maximum Detect                                                                                                                           | 122.5  | Maximum Non-Detect                                              |   | 41.81 |   |   |   |   |   |   |
| 818 | Variance Detects                                                                                                                         | 1067   | Percent Non-Detects                                             |   | 12.5% |   |   |   |   |   |   |
| 819 | Mean Detects                                                                                                                             | 54.61  | SD Detects                                                      |   | 32.66 |   |   |   |   |   |   |
| 820 | Median Detects                                                                                                                           | 42.99  | CV Detects                                                      |   | 0.598 |   |   |   |   |   |   |
| 821 | Skewness Detects                                                                                                                         | 1.885  | Kurtosis Detects                                                |   | 3.658 |   |   |   |   |   |   |
| 822 | Mean of Logged Detects                                                                                                                   | 3.881  | SD of Logged Detects                                            |   | 0.498 |   |   |   |   |   |   |
| 823 |                                                                                                                                          |        |                                                                 |   |       |   |   |   |   |   |   |
| 824 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |        |                                                                 |   |       |   |   |   |   |   |   |
| 825 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |        |                                                                 |   |       |   |   |   |   |   |   |
| 826 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |        |                                                                 |   |       |   |   |   |   |   |   |
| 827 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |        |                                                                 |   |       |   |   |   |   |   |   |
| 828 |                                                                                                                                          |        |                                                                 |   |       |   |   |   |   |   |   |
| 829 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |        |                                                                 |   |       |   |   |   |   |   |   |
| 830 | Shapiro Wilk Test Statistic                                                                                                              | 0.786  | <b>Shapiro Wilk GOF Test</b>                                    |   |       |   |   |   |   |   |   |
| 831 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.803  | Detected Data Not Normal at 5% Significance Level               |   |       |   |   |   |   |   |   |
| 832 | Lilliefors Test Statistic                                                                                                                | 0.294  | <b>Lilliefors GOF Test</b>                                      |   |       |   |   |   |   |   |   |
| 833 | 5% Lilliefors Critical Value                                                                                                             | 0.304  | Detected Data appear Normal at 5% Significance Level            |   |       |   |   |   |   |   |   |
| 834 | <b>Detected Data appear Approximate Normal at 5% Significance Level</b>                                                                  |        |                                                                 |   |       |   |   |   |   |   |   |
| 835 |                                                                                                                                          |        |                                                                 |   |       |   |   |   |   |   |   |
| 836 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 837 | KM Mean                                                                                                                                  | 51.95  | KM Standard Error of Mean                                       |   | 11.17 |   |   |   |   |   |   |
| 838 | KM SD                                                                                                                                    | 29.19  | 95% KM (BCA) UCL                                                |   | 72.29 |   |   |   |   |   |   |
| 839 | 95% KM (t) UCL                                                                                                                           | 73.11  | 95% KM (Percentile Bootstrap) UCL                               |   | 70.74 |   |   |   |   |   |   |
| 840 | 95% KM (z) UCL                                                                                                                           | 70.32  | 95% KM Bootstrap t UCL                                          |   | 118.4 |   |   |   |   |   |   |
| 841 | 90% KM Chebyshev UCL                                                                                                                     | 85.45  | 95% KM Chebyshev UCL                                            |   | 100.6 |   |   |   |   |   |   |
| 842 | 97.5% KM Chebyshev UCL                                                                                                                   | 121.7  | 99% KM Chebyshev UCL                                            |   | 163.1 |   |   |   |   |   |   |
| 843 |                                                                                                                                          |        |                                                                 |   |       |   |   |   |   |   |   |
| 844 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |        |                                                                 |   |       |   |   |   |   |   |   |
| 845 | A-D Test Statistic                                                                                                                       | 0.459  | <b>Anderson-Darling GOF Test</b>                                |   |       |   |   |   |   |   |   |
| 846 | 5% A-D Critical Value                                                                                                                    | 0.71   | detected data appear Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |   |   |
| 847 | K-S Test Statistic                                                                                                                       | 0.254  | <b>Kolmogorov-Smirnov GOF</b>                                   |   |       |   |   |   |   |   |   |
| 848 | 5% K-S Critical Value                                                                                                                    | 0.313  | detected data appear Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |   |   |
| 849 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |        |                                                                 |   |       |   |   |   |   |   |   |
| 850 |                                                                                                                                          |        |                                                                 |   |       |   |   |   |   |   |   |
| 851 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |        |                                                                 |   |       |   |   |   |   |   |   |
| 852 | k hat (MLE)                                                                                                                              | 4.347  | k star (bias corrected MLE)                                     |   | 2.579 |   |   |   |   |   |   |
| 853 | Theta hat (MLE)                                                                                                                          | 12.56  | Theta star (bias corrected MLE)                                 |   | 21.17 |   |   |   |   |   |   |
| 854 | nu hat (MLE)                                                                                                                             | 60.86  | nu star (bias corrected)                                        |   | 36.11 |   |   |   |   |   |   |
| 855 | Mean (detects)                                                                                                                           | 54.61  |                                                                 |   |       |   |   |   |   |   |   |
| 856 |                                                                                                                                          |        |                                                                 |   |       |   |   |   |   |   |   |
| 857 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |        |                                                                 |   |       |   |   |   |   |   |   |
| 858 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |        |                                                                 |   |       |   |   |   |   |   |   |
| 859 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |        |                                                                 |   |       |   |   |   |   |   |   |
| 860 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |        |                                                                 |   |       |   |   |   |   |   |   |
| 861 | This is especially true when the sample size is small.                                                                                   |        |                                                                 |   |       |   |   |   |   |   |   |
| 862 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |        |                                                                 |   |       |   |   |   |   |   |   |
| 863 | Minimum                                                                                                                                  | 27.98  | Mean                                                            |   | 51.28 |   |   |   |   |   |   |
| 864 | Maximum                                                                                                                                  | 122.5  | Median                                                          |   | 40.88 |   |   |   |   |   |   |
| 865 | SD                                                                                                                                       | 31.67  | CV                                                              |   | 0.618 |   |   |   |   |   |   |
| 866 | k hat (MLE)                                                                                                                              | 4.154  | k star (bias corrected MLE)                                     |   | 2.679 |   |   |   |   |   |   |
| 867 | Theta hat (MLE)                                                                                                                          | 12.35  | Theta star (bias corrected MLE)                                 |   | 19.14 |   |   |   |   |   |   |
| 868 | nu hat (MLE)                                                                                                                             | 66.46  | nu star (bias corrected)                                        |   | 42.87 |   |   |   |   |   |   |
| 869 | Adjusted Level of Significance ( $\beta$ )                                                                                               | 0.0195 |                                                                 |   |       |   |   |   |   |   |   |
| 870 | Approximate Chi Square Value (42.87, $\alpha$ )                                                                                          | 28.86  | Adjusted Chi Square Value (42.87, $\beta$ )                     |   | 25.98 |   |   |   |   |   |   |
| 871 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                                        | 76.18  | 95% Gamma Adjusted UCL (use when $n < 50$ )                     |   | 84.61 |   |   |   |   |   |   |

|     | A                                                                                                                                        | B                                                   | C     | D | E | F                           | G | H | I | J                                                       | K     | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|-------|---|---|-----------------------------|---|---|---|---------------------------------------------------------|-------|---|
| 872 |                                                                                                                                          |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 873 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 874 |                                                                                                                                          | Mean (KM)                                           | 51.95 |   |   |                             |   |   |   | SD (KM)                                                 | 29.19 |   |
| 875 |                                                                                                                                          | Variance (KM)                                       | 851.9 |   |   |                             |   |   |   | SE of Mean (KM)                                         | 11.17 |   |
| 876 |                                                                                                                                          | k hat (KM)                                          | 3.168 |   |   |                             |   |   |   | k star (KM)                                             | 2.063 |   |
| 877 |                                                                                                                                          | nu hat (KM)                                         | 50.69 |   |   |                             |   |   |   | nu star (KM)                                            | 33.01 |   |
| 878 |                                                                                                                                          | theta hat (KM)                                      | 16.4  |   |   |                             |   |   |   | theta star (KM)                                         | 25.18 |   |
| 879 |                                                                                                                                          | 80% gamma percentile (KM)                           | 77.49 |   |   |                             |   |   |   | 90% gamma percentile (KM)                               | 100.3 |   |
| 880 |                                                                                                                                          | 95% gamma percentile (KM)                           | 122   |   |   |                             |   |   |   | 99% gamma percentile (KM)                               | 170.1 |   |
| 881 |                                                                                                                                          |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 882 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 883 |                                                                                                                                          | Approximate Chi Square Value (33.01, $\alpha$ )     | 20.88 |   |   |                             |   |   |   | Adjusted Chi Square Value (33.01, $\beta$ )             | 18.48 |   |
| 884 |                                                                                                                                          | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ ) | 82.15 |   |   |                             |   |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )          | 92.83 |   |
| 885 |                                                                                                                                          |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 886 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 887 |                                                                                                                                          | Shapiro Wilk Test Statistic                         | 0.919 |   |   |                             |   |   |   | <b>Shapiro Wilk GOF Test</b>                            |       |   |
| 888 |                                                                                                                                          | 5% Shapiro Wilk Critical Value                      | 0.803 |   |   |                             |   |   |   | Detected Data appear Lognormal at 5% Significance Level |       |   |
| 889 |                                                                                                                                          | Lilliefors Test Statistic                           | 0.221 |   |   |                             |   |   |   | <b>Lilliefors GOF Test</b>                              |       |   |
| 890 |                                                                                                                                          | 5% Lilliefors Critical Value                        | 0.304 |   |   |                             |   |   |   | Detected Data appear Lognormal at 5% Significance Level |       |   |
| 891 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                           |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 892 |                                                                                                                                          |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 893 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 894 |                                                                                                                                          | Mean in Original Scale                              | 51.77 |   |   |                             |   |   |   | Mean in Log Scale                                       | 3.828 |   |
| 895 |                                                                                                                                          | SD in Original Scale                                | 31.29 |   |   |                             |   |   |   | SD in Log Scale                                         | 0.484 |   |
| 896 |                                                                                                                                          | 95% t UCL (assumes normality of ROS data)           | 72.73 |   |   |                             |   |   |   | 95% Percentile Bootstrap UCL                            | 70.3  |   |
| 897 |                                                                                                                                          | 95% BCA Bootstrap UCL                               | 76.06 |   |   |                             |   |   |   | 95% Bootstrap t UCL                                     | 115.5 |   |
| 898 |                                                                                                                                          | 95% H-UCL (Log ROS)                                 | 79.17 |   |   |                             |   |   |   |                                                         |       |   |
| 899 |                                                                                                                                          |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 900 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 901 |                                                                                                                                          | KM Mean (logged)                                    | 3.833 |   |   |                             |   |   |   | KM Geo Mean                                             | 46.2  |   |
| 902 |                                                                                                                                          | KM SD (logged)                                      | 0.452 |   |   |                             |   |   |   | 95% Critical H Value (KM-Log)                           | 2.275 |   |
| 903 |                                                                                                                                          | KM Standard Error of Mean (logged)                  | 0.174 |   |   |                             |   |   |   | 95% H-UCL (KM -Log)                                     | 75.45 |   |
| 904 |                                                                                                                                          | KM SD (logged)                                      | 0.452 |   |   |                             |   |   |   | 95% Critical H Value (KM-Log)                           | 2.275 |   |
| 905 |                                                                                                                                          | KM Standard Error of Mean (logged)                  | 0.174 |   |   |                             |   |   |   |                                                         |       |   |
| 906 |                                                                                                                                          |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 907 | <b>DL/2 Statistics</b>                                                                                                                   |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 908 |                                                                                                                                          | <b>DL/2 Normal</b>                                  |       |   |   | <b>DL/2 Log-Transformed</b> |   |   |   |                                                         |       |   |
| 909 |                                                                                                                                          | Mean in Original Scale                              | 50.4  |   |   |                             |   |   |   | Mean in Log Scale                                       | 3.776 |   |
| 910 |                                                                                                                                          | SD in Original Scale                                | 32.5  |   |   |                             |   |   |   | SD in Log Scale                                         | 0.548 |   |
| 911 |                                                                                                                                          | 95% t UCL (Assumes normality)                       | 72.17 |   |   |                             |   |   |   | 95% H-Stat UCL                                          | 84.07 |   |
| 912 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 913 |                                                                                                                                          |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 914 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 915 | <b>Detected Data appear Approximate Normal Distributed at 5% Significance Level</b>                                                      |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 916 |                                                                                                                                          |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 917 | <b>Suggested UCL to Use</b>                                                                                                              |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 918 |                                                                                                                                          | 95% KM (t) UCL                                      | 73.11 |   |   |                             |   |   |   |                                                         |       |   |
| 919 |                                                                                                                                          |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 920 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                           |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 921 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                   |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 922 |                                                                                                                                          |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 923 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 924 | Recommendations are based upon data size, data distribution, and skewness.                                                               |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 925 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 926 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 927 |                                                                                                                                          |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 928 | <b>Result (deerorgan_manganese)</b>                                                                                                      |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 929 |                                                                                                                                          |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 930 | <b>General Statistics</b>                                                                                                                |                                                     |       |   |   |                             |   |   |   |                                                         |       |   |
| 931 |                                                                                                                                          | Total Number of Observations                        | 8     |   |   |                             |   |   |   | Number of Distinct Observations                         | 8     |   |
| 932 |                                                                                                                                          | Number of Detects                                   | 6     |   |   |                             |   |   |   | Number of Non-Detects                                   | 2     |   |
| 933 |                                                                                                                                          | Number of Distinct Detects                          | 6     |   |   |                             |   |   |   | Number of Distinct Non-Detects                          | 2     |   |
| 934 |                                                                                                                                          | Minimum Detect                                      | 0.238 |   |   |                             |   |   |   | Minimum Non-Detect                                      | 0.711 |   |
| 935 |                                                                                                                                          | Maximum Detect                                      | 3.7   |   |   |                             |   |   |   | Maximum Non-Detect                                      | 0.835 |   |
| 936 |                                                                                                                                          | Variance Detects                                    | 1.931 |   |   |                             |   |   |   | Percent Non-Detects                                     | 25%   |   |
| 937 |                                                                                                                                          | Mean Detects                                        | 1.706 |   |   |                             |   |   |   | SD Detects                                              | 1.389 |   |
| 938 |                                                                                                                                          | Median Detects                                      | 1.412 |   |   |                             |   |   |   | CV Detects                                              | 0.815 |   |

| A    | B                                                                                                                         | C | D | E | F      | G                                                             | H | I | J | K      | L |       |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|---|--------|---------------------------------------------------------------|---|---|---|--------|---|-------|
| 939  | Skewness Detects                                                                                                          |   |   |   | 0.561  | Kurtosis Detects                                              |   |   |   | -1.355 |   |       |
| 940  | Mean of Logged Detects                                                                                                    |   |   |   | 0.143  | SD of Logged Detects                                          |   |   |   | 1.075  |   |       |
| 941  |                                                                                                                           |   |   |   |        |                                                               |   |   |   |        |   |       |
| 942  | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                |   |   |   |        |                                                               |   |   |   |        |   |       |
| 943  | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                    |   |   |   |        |                                                               |   |   |   |        |   |       |
| 944  | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                       |   |   |   |        |                                                               |   |   |   |        |   |       |
| 945  | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                            |   |   |   |        |                                                               |   |   |   |        |   |       |
| 946  |                                                                                                                           |   |   |   |        |                                                               |   |   |   |        |   |       |
| 947  | <b>Normal GOF Test on Detects Only</b>                                                                                    |   |   |   |        |                                                               |   |   |   |        |   |       |
| 948  | Shapiro Wilk Test Statistic                                                                                               |   |   |   | 0.91   | Shapiro Wilk GOF Test                                         |   |   |   |        |   |       |
| 949  | 5% Shapiro Wilk Critical Value                                                                                            |   |   |   | 0.788  | Detected Data appear Normal at 5% Significance Level          |   |   |   |        |   |       |
| 950  | Lilliefors Test Statistic                                                                                                 |   |   |   | 0.231  | Lilliefors GOF Test                                           |   |   |   |        |   |       |
| 951  | 5% Lilliefors Critical Value                                                                                              |   |   |   | 0.325  | Detected Data appear Normal at 5% Significance Level          |   |   |   |        |   |       |
| 952  | <b>Detected Data appear Normal at 5% Significance Level</b>                                                               |   |   |   |        |                                                               |   |   |   |        |   |       |
| 953  |                                                                                                                           |   |   |   |        |                                                               |   |   |   |        |   |       |
| 954  | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |   |   |   |        |                                                               |   |   |   |        |   |       |
| 955  | KM Mean                                                                                                                   |   |   |   | 1.364  | KM Standard Error of Mean                                     |   |   |   | 0.484  |   |       |
| 956  | KM SD                                                                                                                     |   |   |   | 1.248  | 95% KM (BCA) UCL                                              |   |   |   |        |   | 2.209 |
| 957  | 95% KM (t) UCL                                                                                                            |   |   |   | 2.282  | 95% KM (Percentile Bootstrap) UCL                             |   |   |   |        |   | 2.146 |
| 958  | 95% KM (z) UCL                                                                                                            |   |   |   | 2.161  | 95% KM Bootstrap t UCL                                        |   |   |   |        |   | 2.89  |
| 959  | 90% KM Chebyshev UCL                                                                                                      |   |   |   | 2.817  | 95% KM Chebyshev UCL                                          |   |   |   |        |   | 3.476 |
| 960  | 97.5% KM Chebyshev UCL                                                                                                    |   |   |   | 4.389  | 99% KM Chebyshev UCL                                          |   |   |   |        |   | 6.183 |
| 961  |                                                                                                                           |   |   |   |        |                                                               |   |   |   |        |   |       |
| 962  | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |   |        |                                                               |   |   |   |        |   |       |
| 963  | A-D Test Statistic                                                                                                        |   |   |   | 0.275  | Anderson-Darling GOF Test                                     |   |   |   |        |   |       |
| 964  | 5% A-D Critical Value                                                                                                     |   |   |   | 0.709  | detected data appear Gamma Distributed at 5% Significance Lev |   |   |   |        |   |       |
| 965  | K-S Test Statistic                                                                                                        |   |   |   | 0.181  | Kolmogorov-Smirnov GOF                                        |   |   |   |        |   |       |
| 966  | 5% K-S Critical Value                                                                                                     |   |   |   | 0.338  | detected data appear Gamma Distributed at 5% Significance Lev |   |   |   |        |   |       |
| 967  | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                    |   |   |   |        |                                                               |   |   |   |        |   |       |
| 968  |                                                                                                                           |   |   |   |        |                                                               |   |   |   |        |   |       |
| 969  | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |   |        |                                                               |   |   |   |        |   |       |
| 970  | k hat (MLE)                                                                                                               |   |   |   | 1.422  | k star (bias corrected MLE)                                   |   |   |   | 0.822  |   |       |
| 971  | Theta hat (MLE)                                                                                                           |   |   |   | 1.199  | Theta star (bias corrected MLE)                               |   |   |   |        |   | 2.075 |
| 972  | nu hat (MLE)                                                                                                              |   |   |   | 17.06  | nu star (bias corrected)                                      |   |   |   |        |   | 9.866 |
| 973  | Mean (detects)                                                                                                            |   |   |   | 1.706  |                                                               |   |   |   |        |   |       |
| 974  |                                                                                                                           |   |   |   |        |                                                               |   |   |   |        |   |       |
| 975  | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |   |        |                                                               |   |   |   |        |   |       |
| 976  | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |   |        |                                                               |   |   |   |        |   |       |
| 977  | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |   |        |                                                               |   |   |   |        |   |       |
| 978  | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |   |        |                                                               |   |   |   |        |   |       |
| 979  | This is especially true when the sample size is small.                                                                    |   |   |   |        |                                                               |   |   |   |        |   |       |
| 980  | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |   |        |                                                               |   |   |   |        |   |       |
| 981  | Minimum                                                                                                                   |   |   |   | 0.238  | Mean                                                          |   |   |   | 1.345  |   |       |
| 982  | Maximum                                                                                                                   |   |   |   | 3.7    | Median                                                        |   |   |   | 0.893  |   |       |
| 983  | SD                                                                                                                        |   |   |   | 1.351  | CV                                                            |   |   |   | 1.004  |   |       |
| 984  | k hat (MLE)                                                                                                               |   |   |   | 1.095  | k star (bias corrected MLE)                                   |   |   |   | 0.768  |   |       |
| 985  | Theta hat (MLE)                                                                                                           |   |   |   | 1.229  | Theta star (bias corrected MLE)                               |   |   |   |        |   | 1.753 |
| 986  | nu hat (MLE)                                                                                                              |   |   |   | 17.52  | nu star (bias corrected)                                      |   |   |   |        |   | 12.28 |
| 987  | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   |   | 0.0195 |                                                               |   |   |   |        |   |       |
| 988  | Approximate Chi Square Value (12.28, $\alpha$ )                                                                           |   |   |   | 5.412  | Adjusted Chi Square Value (12.28, $\beta$ )                   |   |   |   | 4.316  |   |       |
| 989  | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   |   | 3.053  | 95% Gamma Adjusted UCL (use when $n < 50$ )                   |   |   |   | 3.828  |   |       |
| 990  |                                                                                                                           |   |   |   |        |                                                               |   |   |   |        |   |       |
| 991  | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |   |        |                                                               |   |   |   |        |   |       |
| 992  | Mean (KM)                                                                                                                 |   |   |   | 1.364  | SD (KM)                                                       |   |   |   | 1.248  |   |       |
| 993  | Variance (KM)                                                                                                             |   |   |   | 1.558  | SE of Mean (KM)                                               |   |   |   |        |   | 0.484 |
| 994  | k hat (KM)                                                                                                                |   |   |   | 1.195  | k star (KM)                                                   |   |   |   |        |   | 0.83  |
| 995  | nu hat (KM)                                                                                                               |   |   |   | 19.11  | nu star (KM)                                                  |   |   |   |        |   | 13.28 |
| 996  | theta hat (KM)                                                                                                            |   |   |   | 1.142  | theta star (KM)                                               |   |   |   |        |   | 1.644 |
| 997  | 80% gamma percentile (KM)                                                                                                 |   |   |   | 2.225  | 90% gamma percentile (KM)                                     |   |   |   |        |   | 3.288 |
| 998  | 95% gamma percentile (KM)                                                                                                 |   |   |   | 4.368  | 99% gamma percentile (KM)                                     |   |   |   |        |   | 6.911 |
| 999  |                                                                                                                           |   |   |   |        |                                                               |   |   |   |        |   |       |
| 1000 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |   |        |                                                               |   |   |   |        |   |       |
| 1001 | Approximate Chi Square Value (13.28, $\alpha$ )                                                                           |   |   |   | 6.082  | Adjusted Chi Square Value (13.28, $\beta$ )                   |   |   |   | 4.905  |   |       |
| 1002 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   |   |   | 2.98   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )                |   |   |   | 3.694  |   |       |
| 1003 |                                                                                                                           |   |   |   |        |                                                               |   |   |   |        |   |       |
| 1004 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |   |        |                                                               |   |   |   |        |   |       |
| 1005 | Shapiro Wilk Test Statistic                                                                                               |   |   |   | 0.925  | Shapiro Wilk GOF Test                                         |   |   |   |        |   |       |

| A    | B                                                                                                                                        | C | D | E         | F                                                       | G | H | I      | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|-----------|---------------------------------------------------------|---|---|--------|---|---|---|
| 1006 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.788     | Detected Data appear Lognormal at 5% Significance Level |   |   |        |   |   |   |
| 1007 | Lilliefors Test Statistic                                                                                                                |   |   | 0.222     | <b>Lilliefors GOF Test</b>                              |   |   |        |   |   |   |
| 1008 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.325     | Detected Data appear Lognormal at 5% Significance Level |   |   |        |   |   |   |
| 1009 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                           |   |   |           |                                                         |   |   |        |   |   |   |
| 1010 |                                                                                                                                          |   |   |           |                                                         |   |   |        |   |   |   |
| 1011 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |   |   |           |                                                         |   |   |        |   |   |   |
| 1012 | Mean in Original Scale                                                                                                                   |   |   | 1.367     | Mean in Log Scale                                       |   |   | -0.154 |   |   |   |
| 1013 | SD in Original Scale                                                                                                                     |   |   | 1.331     | SD in Log Scale                                         |   |   | 1.062  |   |   |   |
| 1014 | 95% t UCL (assumes normality of ROS data)                                                                                                |   |   | 2.259     | 95% Percentile Bootstrap UCL                            |   |   | 2.161  |   |   |   |
| 1015 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 2.264     | 95% Bootstrap t UCL                                     |   |   | 2.919  |   |   |   |
| 1016 | 95% H-UCL (Log ROS)                                                                                                                      |   |   | 6.337     |                                                         |   |   |        |   |   |   |
| 1017 |                                                                                                                                          |   |   |           |                                                         |   |   |        |   |   |   |
| 1018 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |   |           |                                                         |   |   |        |   |   |   |
| 1019 | KM Mean (logged)                                                                                                                         |   |   | -0.174    | KM Geo Mean                                             |   |   | 0.841  |   |   |   |
| 1020 | KM SD (logged)                                                                                                                           |   |   | 1.023     | 95% Critical H Value (KM-Log)                           |   |   | 3.483  |   |   |   |
| 1021 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.405     | 95% H-UCL (KM -Log)                                     |   |   | 5.455  |   |   |   |
| 1022 | KM SD (logged)                                                                                                                           |   |   | 1.023     | 95% Critical H Value (KM-Log)                           |   |   | 3.483  |   |   |   |
| 1023 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.405     |                                                         |   |   |        |   |   |   |
| 1024 |                                                                                                                                          |   |   |           |                                                         |   |   |        |   |   |   |
| 1025 | <b>DL/2 Statistics</b>                                                                                                                   |   |   |           |                                                         |   |   |        |   |   |   |
| 1026 | <b>DL/2 Normal</b>                                                                                                                       |   |   |           | <b>DL/2 Log-Transformed</b>                             |   |   |        |   |   |   |
| 1027 | Mean in Original Scale                                                                                                                   |   |   | 1.376     | Mean in Log Scale                                       |   |   | -0.131 |   |   |   |
| 1028 | SD in Original Scale                                                                                                                     |   |   | 1.324     | SD in Log Scale                                         |   |   | 1.041  |   |   |   |
| 1029 | 95% t UCL (Assumes normality)                                                                                                            |   |   | 2.262     | 95% H-Stat UCL                                          |   |   | 6.047  |   |   |   |
| 1030 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |   |           |                                                         |   |   |        |   |   |   |
| 1031 |                                                                                                                                          |   |   |           |                                                         |   |   |        |   |   |   |
| 1032 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |           |                                                         |   |   |        |   |   |   |
| 1033 | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                  |   |   |           |                                                         |   |   |        |   |   |   |
| 1034 |                                                                                                                                          |   |   |           |                                                         |   |   |        |   |   |   |
| 1035 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |           |                                                         |   |   |        |   |   |   |
| 1036 | 95% KM (t) UCL                                                                                                                           |   |   | 2.282     |                                                         |   |   |        |   |   |   |
| 1037 |                                                                                                                                          |   |   |           |                                                         |   |   |        |   |   |   |
| 1038 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |           |                                                         |   |   |        |   |   |   |
| 1039 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |           |                                                         |   |   |        |   |   |   |
| 1040 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |           |                                                         |   |   |        |   |   |   |
| 1041 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |           |                                                         |   |   |        |   |   |   |
| 1042 |                                                                                                                                          |   |   |           |                                                         |   |   |        |   |   |   |
| 1043 | <b>Result (deerorgan_mercury)</b>                                                                                                        |   |   |           |                                                         |   |   |        |   |   |   |
| 1044 |                                                                                                                                          |   |   |           |                                                         |   |   |        |   |   |   |
| 1045 | <b>General Statistics</b>                                                                                                                |   |   |           |                                                         |   |   |        |   |   |   |
| 1046 | Total Number of Observations                                                                                                             |   |   | 8         | Number of Distinct Observations                         |   |   | 8      |   |   |   |
| 1047 | Number of Detects                                                                                                                        |   |   | 3         | Number of Non-Detects                                   |   |   | 5      |   |   |   |
| 1048 | Number of Distinct Detects                                                                                                               |   |   | 3         | Number of Distinct Non-Detects                          |   |   | 5      |   |   |   |
| 1049 | Minimum Detect                                                                                                                           |   |   | 0.017     | Minimum Non-Detect                                      |   |   | 0.0125 |   |   |   |
| 1050 | Maximum Detect                                                                                                                           |   |   | 0.0491    | Maximum Non-Detect                                      |   |   | 0.0373 |   |   |   |
| 1051 | Variance Detects                                                                                                                         |   |   | 2.5825E-4 | Percent Non-Detects                                     |   |   | 62.5%  |   |   |   |
| 1052 | Mean Detects                                                                                                                             |   |   | 0.0327    | SD Detects                                              |   |   | 0.0161 |   |   |   |
| 1053 | Median Detects                                                                                                                           |   |   | 0.0319    | CV Detects                                              |   |   | 0.492  |   |   |   |
| 1054 | Skewness Detects                                                                                                                         |   |   | 0.209     | Kurtosis Detects                                        |   |   | N/A    |   |   |   |
| 1055 | Mean of Logged Detects                                                                                                                   |   |   | -3.511    | SD of Logged Detects                                    |   |   | 0.534  |   |   |   |
| 1056 |                                                                                                                                          |   |   |           |                                                         |   |   |        |   |   |   |
| 1057 | <b>Warning: Data set has only 3 Detected Values.</b>                                                                                     |   |   |           |                                                         |   |   |        |   |   |   |
| 1058 | <b>This is not enough to compute meaningful or reliable statistics and estimates.</b>                                                    |   |   |           |                                                         |   |   |        |   |   |   |
| 1059 |                                                                                                                                          |   |   |           |                                                         |   |   |        |   |   |   |
| 1060 |                                                                                                                                          |   |   |           |                                                         |   |   |        |   |   |   |
| 1061 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |   |   |           |                                                         |   |   |        |   |   |   |
| 1062 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |   |   |           |                                                         |   |   |        |   |   |   |
| 1063 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |   |   |           |                                                         |   |   |        |   |   |   |
| 1064 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |   |   |           |                                                         |   |   |        |   |   |   |
| 1065 |                                                                                                                                          |   |   |           |                                                         |   |   |        |   |   |   |
| 1066 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |   |           |                                                         |   |   |        |   |   |   |
| 1067 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.998     | <b>Shapiro Wilk GOF Test</b>                            |   |   |        |   |   |   |
| 1068 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.767     | Detected Data appear Normal at 5% Significance Level    |   |   |        |   |   |   |
| 1069 | Lilliefors Test Statistic                                                                                                                |   |   | 0.185     | <b>Lilliefors GOF Test</b>                              |   |   |        |   |   |   |
| 1070 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.425     | Detected Data appear Normal at 5% Significance Level    |   |   |        |   |   |   |
| 1071 | <b>Detected Data appear Normal at 5% Significance Level</b>                                                                              |   |   |           |                                                         |   |   |        |   |   |   |
| 1072 |                                                                                                                                          |   |   |           |                                                         |   |   |        |   |   |   |

| A    | B                                                                                                                         | C                                                   | D         | E | F | G                                                       | H | I | J | K       | L |
|------|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|-----------|---|---|---------------------------------------------------------|---|---|---|---------|---|
| 1073 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1074 |                                                                                                                           | KM Mean                                             | 0.0212    |   |   | KM Standard Error of Mean                               |   |   |   | 0.00582 |   |
| 1075 |                                                                                                                           | KM SD                                               | 0.0127    |   |   | 95% KM (BCA) UCL                                        |   |   |   | N/A     |   |
| 1076 |                                                                                                                           | 95% KM (t) UCL                                      | 0.0323    |   |   | 95% KM (Percentile Bootstrap) UCL                       |   |   |   | N/A     |   |
| 1077 |                                                                                                                           | 95% KM (z) UCL                                      | 0.0308    |   |   | 95% KM Bootstrap t UCL                                  |   |   |   | N/A     |   |
| 1078 |                                                                                                                           | 90% KM Chebyshev UCL                                | 0.0387    |   |   | 95% KM Chebyshev UCL                                    |   |   |   | 0.0466  |   |
| 1079 |                                                                                                                           | 97.5% KM Chebyshev UCL                              | 0.0576    |   |   | 99% KM Chebyshev UCL                                    |   |   |   | 0.0791  |   |
| 1080 |                                                                                                                           |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1081 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1082 | <b>Not Enough Data to Perform GOF Test</b>                                                                                |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1083 |                                                                                                                           |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1084 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1085 |                                                                                                                           | k hat (MLE)                                         | 5.721     |   |   | k star (bias corrected MLE)                             |   |   |   | N/A     |   |
| 1086 |                                                                                                                           | Theta hat (MLE)                                     | 0.00571   |   |   | Theta star (bias corrected MLE)                         |   |   |   | N/A     |   |
| 1087 |                                                                                                                           | nu hat (MLE)                                        | 34.33     |   |   | nu star (bias corrected)                                |   |   |   | N/A     |   |
| 1088 |                                                                                                                           | Mean (detects)                                      | 0.0327    |   |   |                                                         |   |   |   |         |   |
| 1089 |                                                                                                                           |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1090 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1091 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1092 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1093 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1094 | This is especially true when the sample size is small.                                                                    |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1095 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1096 |                                                                                                                           | Minimum                                             | 0.01      |   |   | Mean                                                    |   |   |   | 0.0185  |   |
| 1097 |                                                                                                                           | Maximum                                             | 0.0491    |   |   | Median                                                  |   |   |   | 0.01    |   |
| 1098 |                                                                                                                           | SD                                                  | 0.0145    |   |   | CV                                                      |   |   |   | 0.786   |   |
| 1099 |                                                                                                                           | k hat (MLE)                                         | 2.594     |   |   | k star (bias corrected MLE)                             |   |   |   | 1.704   |   |
| 1100 |                                                                                                                           | Theta hat (MLE)                                     | 0.00713   |   |   | Theta star (bias corrected MLE)                         |   |   |   | 0.0109  |   |
| 1101 |                                                                                                                           | nu hat (MLE)                                        | 41.5      |   |   | nu star (bias corrected)                                |   |   |   | 27.27   |   |
| 1102 |                                                                                                                           | Adjusted Level of Significance ( $\beta$ )          | 0.0195    |   |   |                                                         |   |   |   |         |   |
| 1103 |                                                                                                                           | Approximate Chi Square Value (27.27, $\alpha$ )     | 16.36     |   |   | Adjusted Chi Square Value (27.27, $\beta$ )             |   |   |   | 14.27   |   |
| 1104 |                                                                                                                           | 95% Gamma Approximate UCL (use when $n \geq 50$ )   | 0.0308    |   |   | 95% Gamma Adjusted UCL (use when $n < 50$ )             |   |   |   | N/A     |   |
| 1105 |                                                                                                                           |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1106 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1107 |                                                                                                                           | Mean (KM)                                           | 0.0212    |   |   | SD (KM)                                                 |   |   |   | 0.0127  |   |
| 1108 |                                                                                                                           | Variance (KM)                                       | 1.6066E-4 |   |   | SE of Mean (KM)                                         |   |   |   | 0.00582 |   |
| 1109 |                                                                                                                           | k hat (KM)                                          | 2.807     |   |   | k star (KM)                                             |   |   |   | 1.837   |   |
| 1110 |                                                                                                                           | nu hat (KM)                                         | 44.91     |   |   | nu star (KM)                                            |   |   |   | 29.4    |   |
| 1111 |                                                                                                                           | theta hat (KM)                                      | 0.00757   |   |   | theta star (KM)                                         |   |   |   | 0.0116  |   |
| 1112 |                                                                                                                           | 80% gamma percentile (KM)                           | 0.0321    |   |   | 90% gamma percentile (KM)                               |   |   |   | 0.0421  |   |
| 1113 |                                                                                                                           | 95% gamma percentile (KM)                           | 0.0517    |   |   | 99% gamma percentile (KM)                               |   |   |   | 0.0732  |   |
| 1114 |                                                                                                                           |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1115 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1116 |                                                                                                                           | Approximate Chi Square Value (29.40, $\alpha$ )     | 18.02     |   |   | Adjusted Chi Square Value (29.40, $\beta$ )             |   |   |   | 15.81   |   |
| 1117 |                                                                                                                           | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ ) | 0.0346    |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )          |   |   |   | 0.0395  |   |
| 1118 |                                                                                                                           |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1119 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1120 |                                                                                                                           | Shapiro Wilk Test Statistic                         | 0.988     |   |   | <b>Shapiro Wilk GOF Test</b>                            |   |   |   |         |   |
| 1121 |                                                                                                                           | 5% Shapiro Wilk Critical Value                      | 0.767     |   |   | Detected Data appear Lognormal at 5% Significance Level |   |   |   |         |   |
| 1122 |                                                                                                                           | Lilliefors Test Statistic                           | 0.216     |   |   | <b>Lilliefors GOF Test</b>                              |   |   |   |         |   |
| 1123 |                                                                                                                           | 5% Lilliefors Critical Value                        | 0.425     |   |   | Detected Data appear Lognormal at 5% Significance Level |   |   |   |         |   |
| 1124 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                            |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1125 |                                                                                                                           |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1126 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1127 |                                                                                                                           | Mean in Original Scale                              | 0.0186    |   |   | Mean in Log Scale                                       |   |   |   | -4.193  |   |
| 1128 |                                                                                                                           | SD in Original Scale                                | 0.0145    |   |   | SD in Log Scale                                         |   |   |   | 0.654   |   |
| 1129 |                                                                                                                           | 95% t UCL (assumes normality of ROS data)           | 0.0284    |   |   | 95% Percentile Bootstrap UCL                            |   |   |   | 0.0269  |   |
| 1130 |                                                                                                                           | 95% BCA Bootstrap UCL                               | 0.0296    |   |   | 95% Bootstrap t UCL                                     |   |   |   | 0.0526  |   |
| 1131 |                                                                                                                           | 95% H-UCL (Log ROS)                                 | 0.0359    |   |   |                                                         |   |   |   |         |   |
| 1132 |                                                                                                                           |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1133 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |                                                     |           |   |   |                                                         |   |   |   |         |   |
| 1134 |                                                                                                                           | KM Mean (logged)                                    | -3.995    |   |   | KM Geo Mean                                             |   |   |   | 0.0184  |   |
| 1135 |                                                                                                                           | KM SD (logged)                                      | 0.505     |   |   | 95% Critical H Value (KM-Log)                           |   |   |   | 2.362   |   |
| 1136 |                                                                                                                           | KM Standard Error of Mean (logged)                  | 0.238     |   |   | 95% H-UCL (KM -Log)                                     |   |   |   | 0.0328  |   |
| 1137 |                                                                                                                           | KM SD (logged)                                      | 0.505     |   |   | 95% Critical H Value (KM-Log)                           |   |   |   | 2.362   |   |
| 1138 |                                                                                                                           | KM Standard Error of Mean (logged)                  | 0.238     |   |   |                                                         |   |   |   |         |   |
| 1139 |                                                                                                                           |                                                     |           |   |   |                                                         |   |   |   |         |   |

| A    | B                                                                                                                                      | C | D | E      | F | G                                                             | H | I | J      | K | L |
|------|----------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|---|---------------------------------------------------------------|---|---|--------|---|---|
| 1140 | <b>DL/2 Statistics</b>                                                                                                                 |   |   |        |   |                                                               |   |   |        |   |   |
| 1141 | <b>DL/2 Normal</b>                                                                                                                     |   |   |        |   | <b>DL/2 Log-Transformed</b>                                   |   |   |        |   |   |
| 1142 | Mean in Original Scale                                                                                                                 |   |   | 0.0193 |   | Mean in Log Scale                                             |   |   | -4.201 |   |   |
| 1143 | SD in Original Scale                                                                                                                   |   |   | 0.0148 |   | SD in Log Scale                                               |   |   | 0.769  |   |   |
| 1144 | 95% t UCL (Assumes normality)                                                                                                          |   |   | 0.0293 |   | 95% H-Stat UCL                                                |   |   | 0.0466 |   |   |
| 1145 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                               |   |   |        |   |                                                               |   |   |        |   |   |
| 1146 |                                                                                                                                        |   |   |        |   |                                                               |   |   |        |   |   |
| 1147 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                  |   |   |        |   |                                                               |   |   |        |   |   |
| 1148 | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                |   |   |        |   |                                                               |   |   |        |   |   |
| 1149 |                                                                                                                                        |   |   |        |   |                                                               |   |   |        |   |   |
| 1150 | <b>Suggested UCL to Use</b>                                                                                                            |   |   |        |   |                                                               |   |   |        |   |   |
| 1151 | 95% KM (t) UCL                                                                                                                         |   |   | 0.0323 |   |                                                               |   |   |        |   |   |
| 1152 |                                                                                                                                        |   |   |        |   |                                                               |   |   |        |   |   |
| 1153 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.           |   |   |        |   |                                                               |   |   |        |   |   |
| 1154 | Recommendations are based upon data size, data distribution, and skewness.                                                             |   |   |        |   |                                                               |   |   |        |   |   |
| 1155 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).               |   |   |        |   |                                                               |   |   |        |   |   |
| 1156 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistica |   |   |        |   |                                                               |   |   |        |   |   |
| 1157 |                                                                                                                                        |   |   |        |   |                                                               |   |   |        |   |   |
| 1158 | <b>Result (deerorgan_thallium)</b>                                                                                                     |   |   |        |   |                                                               |   |   |        |   |   |
| 1159 |                                                                                                                                        |   |   |        |   |                                                               |   |   |        |   |   |
| 1160 | <b>General Statistics</b>                                                                                                              |   |   |        |   |                                                               |   |   |        |   |   |
| 1161 | Total Number of Observations                                                                                                           |   |   | 8      |   | Number of Distinct Observations                               |   |   | 8      |   |   |
| 1162 | Number of Detects                                                                                                                      |   |   | 0      |   | Number of Non-Detects                                         |   |   | 8      |   |   |
| 1163 | Number of Distinct Detects                                                                                                             |   |   | 0      |   | Number of Distinct Non-Detects                                |   |   | 8      |   |   |
| 1164 |                                                                                                                                        |   |   |        |   |                                                               |   |   |        |   |   |
| 1165 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                     |   |   |        |   |                                                               |   |   |        |   |   |
| 1166 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>               |   |   |        |   |                                                               |   |   |        |   |   |
| 1167 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>      |   |   |        |   |                                                               |   |   |        |   |   |
| 1168 |                                                                                                                                        |   |   |        |   |                                                               |   |   |        |   |   |
| 1169 | <b>The data set for variable Result (deerorgan_thallium) was not processed!</b>                                                        |   |   |        |   |                                                               |   |   |        |   |   |
| 1170 |                                                                                                                                        |   |   |        |   |                                                               |   |   |        |   |   |
| 1171 |                                                                                                                                        |   |   |        |   |                                                               |   |   |        |   |   |
| 1172 |                                                                                                                                        |   |   |        |   |                                                               |   |   |        |   |   |
| 1173 | <b>Result (deerorgan_zinc)</b>                                                                                                         |   |   |        |   |                                                               |   |   |        |   |   |
| 1174 |                                                                                                                                        |   |   |        |   |                                                               |   |   |        |   |   |
| 1175 | <b>General Statistics</b>                                                                                                              |   |   |        |   |                                                               |   |   |        |   |   |
| 1176 | Total Number of Observations                                                                                                           |   |   | 7      |   | Number of Distinct Observations                               |   |   | 7      |   |   |
| 1177 |                                                                                                                                        |   |   |        |   | Number of Missing Observations                                |   |   | 0      |   |   |
| 1178 | Minimum                                                                                                                                |   |   | 5.938  |   | Mean                                                          |   |   | 19     |   |   |
| 1179 | Maximum                                                                                                                                |   |   | 33.74  |   | Median                                                        |   |   | 16.39  |   |   |
| 1180 | SD                                                                                                                                     |   |   | 9.92   |   | Std. Error of Mean                                            |   |   | 3.75   |   |   |
| 1181 | Coefficient of Variation                                                                                                               |   |   | 0.522  |   | Skewness                                                      |   |   | 0.588  |   |   |
| 1182 |                                                                                                                                        |   |   |        |   |                                                               |   |   |        |   |   |
| 1183 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                             |   |   |        |   |                                                               |   |   |        |   |   |
| 1184 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                 |   |   |        |   |                                                               |   |   |        |   |   |
| 1185 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                    |   |   |        |   |                                                               |   |   |        |   |   |
| 1186 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                         |   |   |        |   |                                                               |   |   |        |   |   |
| 1187 |                                                                                                                                        |   |   |        |   |                                                               |   |   |        |   |   |
| 1188 | <b>Normal GOF Test</b>                                                                                                                 |   |   |        |   |                                                               |   |   |        |   |   |
| 1189 | Shapiro Wilk Test Statistic                                                                                                            |   |   | 0.891  |   | <b>Shapiro Wilk GOF Test</b>                                  |   |   |        |   |   |
| 1190 | 5% Shapiro Wilk Critical Value                                                                                                         |   |   | 0.803  |   | Data appear Normal at 5% Significance Level                   |   |   |        |   |   |
| 1191 | Lilliefors Test Statistic                                                                                                              |   |   | 0.3    |   | <b>Lilliefors GOF Test</b>                                    |   |   |        |   |   |
| 1192 | 5% Lilliefors Critical Value                                                                                                           |   |   | 0.304  |   | Data appear Normal at 5% Significance Level                   |   |   |        |   |   |
| 1193 | <b>Data appear Normal at 5% Significance Level</b>                                                                                     |   |   |        |   |                                                               |   |   |        |   |   |
| 1194 |                                                                                                                                        |   |   |        |   |                                                               |   |   |        |   |   |
| 1195 | <b>Assuming Normal Distribution</b>                                                                                                    |   |   |        |   |                                                               |   |   |        |   |   |
| 1196 | <b>95% Normal UCL</b>                                                                                                                  |   |   |        |   | <b>95% UCLs (Adjusted for Skewness)</b>                       |   |   |        |   |   |
| 1197 | 95% Student's-t UCL                                                                                                                    |   |   | 26.29  |   | 95% Adjusted-CLT UCL (Chen-1995)                              |   |   | 26.06  |   |   |
| 1198 |                                                                                                                                        |   |   |        |   | 95% Modified-t UCL (Johnson-1978)                             |   |   | 26.43  |   |   |
| 1199 |                                                                                                                                        |   |   |        |   |                                                               |   |   |        |   |   |
| 1200 | <b>Gamma GOF Test</b>                                                                                                                  |   |   |        |   |                                                               |   |   |        |   |   |
| 1201 | A-D Test Statistic                                                                                                                     |   |   | 0.397  |   | <b>Anderson-Darling Gamma GOF Test</b>                        |   |   |        |   |   |
| 1202 | 5% A-D Critical Value                                                                                                                  |   |   | 0.71   |   | Detected data appear Gamma Distributed at 5% Significance Lev |   |   |        |   |   |
| 1203 | K-S Test Statistic                                                                                                                     |   |   | 0.24   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                      |   |   |        |   |   |
| 1204 | 5% K-S Critical Value                                                                                                                  |   |   | 0.313  |   | Detected data appear Gamma Distributed at 5% Significance Lev |   |   |        |   |   |
| 1205 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                 |   |   |        |   |                                                               |   |   |        |   |   |
| 1206 |                                                                                                                                        |   |   |        |   |                                                               |   |   |        |   |   |

| A    | B                                                                                                                                        | C | D      | E | F                                              | G | H     | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|---|------------------------------------------------|---|-------|---|---|---|---|
| 1207 | <b>Gamma Statistics</b>                                                                                                                  |   |        |   |                                                |   |       |   |   |   |   |
| 1208 | k hat (MLE)                                                                                                                              |   | 3.979  |   | k star (bias corrected MLE)                    |   | 2.369 |   |   |   |   |
| 1209 | Theta hat (MLE)                                                                                                                          |   | 4.776  |   | Theta star (bias corrected MLE)                |   | 8.022 |   |   |   |   |
| 1210 | nu hat (MLE)                                                                                                                             |   | 55.7   |   | nu star (bias corrected)                       |   | 33.16 |   |   |   |   |
| 1211 | MLE Mean (bias corrected)                                                                                                                |   | 19     |   | MLE Sd (bias corrected)                        |   | 12.35 |   |   |   |   |
| 1212 |                                                                                                                                          |   |        |   | Approximate Chi Square Value (0.05)            |   | 21    |   |   |   |   |
| 1213 | Adjusted Level of Significance                                                                                                           |   | 0.0158 |   | Adjusted Chi Square Value                      |   | 18.13 |   |   |   |   |
| 1214 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |
| 1215 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |        |   |                                                |   |       |   |   |   |   |
| 1216 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   | 30.02  |   | 95% Adjusted Gamma UCL (use when n<50)         |   | 34.76 |   |   |   |   |
| 1217 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |
| 1218 | <b>Lognormal GOF Test</b>                                                                                                                |   |        |   |                                                |   |       |   |   |   |   |
| 1219 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.911  |   | <b>Shapiro Wilk Lognormal GOF Test</b>         |   |       |   |   |   |   |
| 1220 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.803  |   | Data appear Lognormal at 5% Significance Level |   |       |   |   |   |   |
| 1221 | Lilliefors Test Statistic                                                                                                                |   | 0.206  |   | <b>Lilliefors Lognormal GOF Test</b>           |   |       |   |   |   |   |
| 1222 | 5% Lilliefors Critical Value                                                                                                             |   | 0.304  |   | Data appear Lognormal at 5% Significance Level |   |       |   |   |   |   |
| 1223 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |        |   |                                                |   |       |   |   |   |   |
| 1224 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |
| 1225 | <b>Lognormal Statistics</b>                                                                                                              |   |        |   |                                                |   |       |   |   |   |   |
| 1226 | Minimum of Logged Data                                                                                                                   |   | 1.781  |   | Mean of logged Data                            |   | 2.814 |   |   |   |   |
| 1227 | Maximum of Logged Data                                                                                                                   |   | 3.519  |   | SD of logged Data                              |   | 0.58  |   |   |   |   |
| 1228 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |
| 1229 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |        |   |                                                |   |       |   |   |   |   |
| 1230 | 95% H-UCL                                                                                                                                |   | 36.74  |   | 90% Chebyshev (MVUE) UCL                       |   | 31.9  |   |   |   |   |
| 1231 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 37.66  |   | 97.5% Chebyshev (MVUE) UCL                     |   | 45.64 |   |   |   |   |
| 1232 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 61.32  |   |                                                |   |       |   |   |   |   |
| 1233 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |
| 1234 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |        |   |                                                |   |       |   |   |   |   |
| 1235 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |        |   |                                                |   |       |   |   |   |   |
| 1236 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |
| 1237 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |        |   |                                                |   |       |   |   |   |   |
| 1238 | 95% CLT UCL                                                                                                                              |   | 25.17  |   | 95% Jackknife UCL                              |   | 26.29 |   |   |   |   |
| 1239 | 95% Standard Bootstrap UCL                                                                                                               |   | 24.63  |   | 95% Bootstrap-t UCL                            |   | 31.57 |   |   |   |   |
| 1240 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 107    |   | 95% Percentile Bootstrap UCL                   |   | 25.12 |   |   |   |   |
| 1241 | 95% BCA Bootstrap UCL                                                                                                                    |   | 25.54  |   |                                                |   |       |   |   |   |   |
| 1242 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 30.25  |   | 95% Chebyshev(Mean, Sd) UCL                    |   | 35.35 |   |   |   |   |
| 1243 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 42.42  |   | 99% Chebyshev(Mean, Sd) UCL                    |   | 56.31 |   |   |   |   |
| 1244 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |
| 1245 | <b>Suggested UCL to Use</b>                                                                                                              |   |        |   |                                                |   |       |   |   |   |   |
| 1246 | 95% Student's-t UCL                                                                                                                      |   | 26.29  |   |                                                |   |       |   |   |   |   |
| 1247 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |
| 1248 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |   |                                                |   |       |   |   |   |   |
| 1249 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |   |                                                |   |       |   |   |   |   |
| 1250 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |   |                                                |   |       |   |   |   |   |
| 1251 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |   |                                                |   |       |   |   |   |   |
| 1252 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |
| 1253 | <b>Result (grousemuscle_antimony)</b>                                                                                                    |   |        |   |                                                |   |       |   |   |   |   |
| 1254 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |
| 1255 | <b>General Statistics</b>                                                                                                                |   |        |   |                                                |   |       |   |   |   |   |
| 1256 | Total Number of Observations                                                                                                             |   | 3      |   | Number of Distinct Observations                |   | 3     |   |   |   |   |
| 1257 | Number of Detects                                                                                                                        |   | 0      |   | Number of Non-Detects                          |   | 3     |   |   |   |   |
| 1258 | Number of Distinct Detects                                                                                                               |   | 0      |   | Number of Distinct Non-Detects                 |   | 3     |   |   |   |   |
| 1259 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |
| 1260 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                       |   |        |   |                                                |   |       |   |   |   |   |
| 1261 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>                 |   |        |   |                                                |   |       |   |   |   |   |
| 1262 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>        |   |        |   |                                                |   |       |   |   |   |   |
| 1263 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |
| 1264 | <b>The data set for variable Result (grousemuscle_antimony) was not processed!</b>                                                       |   |        |   |                                                |   |       |   |   |   |   |
| 1265 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |
| 1266 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |
| 1267 | <b>Result (grousemuscle_arsenic)</b>                                                                                                     |   |        |   |                                                |   |       |   |   |   |   |
| 1268 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |
| 1269 | <b>General Statistics</b>                                                                                                                |   |        |   |                                                |   |       |   |   |   |   |
| 1270 | Total Number of Observations                                                                                                             |   | 3      |   | Number of Distinct Observations                |   | 3     |   |   |   |   |
| 1271 | Number of Detects                                                                                                                        |   | 0      |   | Number of Non-Detects                          |   | 3     |   |   |   |   |
| 1272 | Number of Distinct Detects                                                                                                               |   | 0      |   | Number of Distinct Non-Detects                 |   | 3     |   |   |   |   |
| 1273 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |

| A    | B                                                                                                                                         | C         | D                                              | E | F                                       | G      | H     | I | J | K | L |
|------|-------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------------------------------------------|---|-----------------------------------------|--------|-------|---|---|---|---|
| 1274 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                        |           |                                                |   |                                         |        |       |   |   |   |   |
| 1275 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>                  |           |                                                |   |                                         |        |       |   |   |   |   |
| 1276 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>         |           |                                                |   |                                         |        |       |   |   |   |   |
| 1277 |                                                                                                                                           |           |                                                |   |                                         |        |       |   |   |   |   |
| 1278 | <b>The data set for variable Result (grousemuscle_arsenic) was not processed!</b>                                                         |           |                                                |   |                                         |        |       |   |   |   |   |
| 1279 |                                                                                                                                           |           |                                                |   |                                         |        |       |   |   |   |   |
| 1280 |                                                                                                                                           |           |                                                |   |                                         |        |       |   |   |   |   |
| 1281 | <b>Result (grousemuscle_cadmium)</b>                                                                                                      |           |                                                |   |                                         |        |       |   |   |   |   |
| 1282 |                                                                                                                                           |           |                                                |   |                                         |        |       |   |   |   |   |
| 1283 | <b>General Statistics</b>                                                                                                                 |           |                                                |   |                                         |        |       |   |   |   |   |
| 1284 | Total Number of Observations                                                                                                              | 3         |                                                |   | Number of Distinct Observations         | 3      |       |   |   |   |   |
| 1285 | Number of Detects                                                                                                                         | 1         |                                                |   | Number of Non-Detects                   | 2      |       |   |   |   |   |
| 1286 | Number of Distinct Detects                                                                                                                | 1         |                                                |   | Number of Distinct Non-Detects          | 2      |       |   |   |   |   |
| 1287 |                                                                                                                                           |           |                                                |   |                                         |        |       |   |   |   |   |
| 1288 | <b>Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!</b>          |           |                                                |   |                                         |        |       |   |   |   |   |
| 1289 | <b>uggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, B</b> |           |                                                |   |                                         |        |       |   |   |   |   |
| 1290 |                                                                                                                                           |           |                                                |   |                                         |        |       |   |   |   |   |
| 1291 | <b>The data set for variable Result (grousemuscle_cadmium) was not processed!</b>                                                         |           |                                                |   |                                         |        |       |   |   |   |   |
| 1292 |                                                                                                                                           |           |                                                |   |                                         |        |       |   |   |   |   |
| 1293 |                                                                                                                                           |           |                                                |   |                                         |        |       |   |   |   |   |
| 1294 |                                                                                                                                           |           |                                                |   |                                         |        |       |   |   |   |   |
| 1295 | <b>Result (grousemuscle_chromium)</b>                                                                                                     |           |                                                |   |                                         |        |       |   |   |   |   |
| 1296 |                                                                                                                                           |           |                                                |   |                                         |        |       |   |   |   |   |
| 1297 | <b>General Statistics</b>                                                                                                                 |           |                                                |   |                                         |        |       |   |   |   |   |
| 1298 | Total Number of Observations                                                                                                              | 3         |                                                |   | Number of Distinct Observations         | 3      |       |   |   |   |   |
| 1299 |                                                                                                                                           |           |                                                |   | Number of Missing Observations          | 0      |       |   |   |   |   |
| 1300 | Minimum                                                                                                                                   | 0.811     |                                                |   | Mean                                    | 0.842  |       |   |   |   |   |
| 1301 | Maximum                                                                                                                                   | 0.871     |                                                |   | Median                                  | 0.844  |       |   |   |   |   |
| 1302 | SD                                                                                                                                        | 0.0299    |                                                |   | Std. Error of Mean                      | 0.0173 |       |   |   |   |   |
| 1303 | Coefficient of Variation                                                                                                                  | 0.0355    |                                                |   | Skewness                                | -0.259 |       |   |   |   |   |
| 1304 |                                                                                                                                           |           |                                                |   |                                         |        |       |   |   |   |   |
| 1305 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                                |           |                                                |   |                                         |        |       |   |   |   |   |
| 1306 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                    |           |                                                |   |                                         |        |       |   |   |   |   |
| 1307 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                       |           |                                                |   |                                         |        |       |   |   |   |   |
| 1308 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                            |           |                                                |   |                                         |        |       |   |   |   |   |
| 1309 |                                                                                                                                           |           |                                                |   |                                         |        |       |   |   |   |   |
| 1310 | <b>Normal GOF Test</b>                                                                                                                    |           |                                                |   |                                         |        |       |   |   |   |   |
| 1311 | Shapiro Wilk Test Statistic                                                                                                               | 0.997     |                                                |   | <b>Shapiro Wilk GOF Test</b>            |        |       |   |   |   |   |
| 1312 | 5% Shapiro Wilk Critical Value                                                                                                            | 0.767     | Data appear Normal at 5% Significance Level    |   |                                         |        |       |   |   |   |   |
| 1313 | Lilliefors Test Statistic                                                                                                                 | 0.19      |                                                |   | <b>Lilliefors GOF Test</b>              |        |       |   |   |   |   |
| 1314 | 5% Lilliefors Critical Value                                                                                                              | 0.425     | Data appear Normal at 5% Significance Level    |   |                                         |        |       |   |   |   |   |
| 1315 | <b>Data appear Normal at 5% Significance Level</b>                                                                                        |           |                                                |   |                                         |        |       |   |   |   |   |
| 1316 |                                                                                                                                           |           |                                                |   |                                         |        |       |   |   |   |   |
| 1317 | <b>Assuming Normal Distribution</b>                                                                                                       |           |                                                |   |                                         |        |       |   |   |   |   |
| 1318 | <b>95% Normal UCL</b>                                                                                                                     |           |                                                |   | <b>95% UCLs (Adjusted for Skewness)</b> |        |       |   |   |   |   |
| 1319 | 95% Student's-t UCL                                                                                                                       | 0.892     |                                                |   | 95% Adjusted-CLT UCL (Chen-1995)        |        | 0.868 |   |   |   |   |
| 1320 |                                                                                                                                           |           |                                                |   | 95% Modified-t UCL (Johnson-1978)       |        | 0.892 |   |   |   |   |
| 1321 |                                                                                                                                           |           |                                                |   |                                         |        |       |   |   |   |   |
| 1322 | <b>Gamma GOF Test</b>                                                                                                                     |           |                                                |   |                                         |        |       |   |   |   |   |
| 1323 | <b>Not Enough Data to Perform GOF Test</b>                                                                                                |           |                                                |   |                                         |        |       |   |   |   |   |
| 1324 |                                                                                                                                           |           |                                                |   |                                         |        |       |   |   |   |   |
| 1325 | <b>Gamma Statistics</b>                                                                                                                   |           |                                                |   |                                         |        |       |   |   |   |   |
| 1326 | k hat (MLE)                                                                                                                               | 1185      |                                                |   | k star (bias corrected MLE)             | N/A    |       |   |   |   |   |
| 1327 | Theta hat (MLE)                                                                                                                           | 7.1025E-4 |                                                |   | Theta star (bias corrected MLE)         | N/A    |       |   |   |   |   |
| 1328 | nu hat (MLE)                                                                                                                              | 7113      |                                                |   | nu star (bias corrected)                | N/A    |       |   |   |   |   |
| 1329 | MLE Mean (bias corrected)                                                                                                                 | N/A       |                                                |   | MLE Sd (bias corrected)                 | N/A    |       |   |   |   |   |
| 1330 |                                                                                                                                           |           |                                                |   | Approximate Chi Square Value (0.05)     |        | N/A   |   |   |   |   |
| 1331 | Adjusted Level of Significance                                                                                                            | N/A       |                                                |   | Adjusted Chi Square Value               |        | N/A   |   |   |   |   |
| 1332 |                                                                                                                                           |           |                                                |   |                                         |        |       |   |   |   |   |
| 1333 | <b>Assuming Gamma Distribution</b>                                                                                                        |           |                                                |   |                                         |        |       |   |   |   |   |
| 1334 | 95% Approximate Gamma UCL (use when n>=50))                                                                                               | N/A       |                                                |   | 95% Adjusted Gamma UCL (use when n<50)  |        | N/A   |   |   |   |   |
| 1335 |                                                                                                                                           |           |                                                |   |                                         |        |       |   |   |   |   |
| 1336 | <b>Lognormal GOF Test</b>                                                                                                                 |           |                                                |   |                                         |        |       |   |   |   |   |
| 1337 | Shapiro Wilk Test Statistic                                                                                                               | 0.996     |                                                |   | <b>Shapiro Wilk Lognormal GOF Test</b>  |        |       |   |   |   |   |
| 1338 | 5% Shapiro Wilk Critical Value                                                                                                            | 0.767     | Data appear Lognormal at 5% Significance Level |   |                                         |        |       |   |   |   |   |
| 1339 | Lilliefors Test Statistic                                                                                                                 | 0.194     |                                                |   | <b>Lilliefors Lognormal GOF Test</b>    |        |       |   |   |   |   |
| 1340 | 5% Lilliefors Critical Value                                                                                                              | 0.425     | Data appear Lognormal at 5% Significance Level |   |                                         |        |       |   |   |   |   |

| A    | B                                                                                                                                        | C      | D | E                               | F      | G | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------|---|---------------------------------|--------|---|---|---|---|---|---|
| 1341 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |        |   |                                 |        |   |   |   |   |   |   |
| 1342 |                                                                                                                                          |        |   |                                 |        |   |   |   |   |   |   |
| 1343 | <b>Lognormal Statistics</b>                                                                                                              |        |   |                                 |        |   |   |   |   |   |   |
| 1344 | Minimum of Logged Data                                                                                                                   | -0.209 |   | Mean of logged Data             | -0.172 |   |   |   |   |   |   |
| 1345 | Maximum of Logged Data                                                                                                                   | -0.138 |   | SD of logged Data               | 0.0356 |   |   |   |   |   |   |
| 1346 |                                                                                                                                          |        |   |                                 |        |   |   |   |   |   |   |
| 1347 | <b>Assuming Lognormal Distribution</b>                                                                                                   |        |   |                                 |        |   |   |   |   |   |   |
| 1348 | 95% H-UCL                                                                                                                                | N/A    |   | 90% Chebyshev (MVUE) UCL        | 0.894  |   |   |   |   |   |   |
| 1349 | 95% Chebyshev (MVUE) UCL                                                                                                                 | 0.917  |   | 97.5% Chebyshev (MVUE) UCL      | 0.95   |   |   |   |   |   |   |
| 1350 | 99% Chebyshev (MVUE) UCL                                                                                                                 | 1.014  |   |                                 |        |   |   |   |   |   |   |
| 1351 |                                                                                                                                          |        |   |                                 |        |   |   |   |   |   |   |
| 1352 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |   |                                 |        |   |   |   |   |   |   |
| 1353 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |        |   |                                 |        |   |   |   |   |   |   |
| 1354 |                                                                                                                                          |        |   |                                 |        |   |   |   |   |   |   |
| 1355 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |        |   |                                 |        |   |   |   |   |   |   |
| 1356 | 95% CLT UCL                                                                                                                              | 0.87   |   | 95% Jackknife UCL               | 0.892  |   |   |   |   |   |   |
| 1357 | 95% Standard Bootstrap UCL                                                                                                               | N/A    |   | 95% Bootstrap-t UCL             | N/A    |   |   |   |   |   |   |
| 1358 | 95% Hall's Bootstrap UCL                                                                                                                 | N/A    |   | 95% Percentile Bootstrap UCL    | N/A    |   |   |   |   |   |   |
| 1359 | 95% BCA Bootstrap UCL                                                                                                                    | N/A    |   |                                 |        |   |   |   |   |   |   |
| 1360 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              | 0.894  |   | 95% Chebyshev(Mean, Sd) UCL     | 0.917  |   |   |   |   |   |   |
| 1361 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            | 0.95   |   | 99% Chebyshev(Mean, Sd) UCL     | 1.014  |   |   |   |   |   |   |
| 1362 |                                                                                                                                          |        |   |                                 |        |   |   |   |   |   |   |
| 1363 | <b>Suggested UCL to Use</b>                                                                                                              |        |   |                                 |        |   |   |   |   |   |   |
| 1364 | 95% Student's-t UCL                                                                                                                      | 0.892  |   |                                 |        |   |   |   |   |   |   |
| 1365 |                                                                                                                                          |        |   |                                 |        |   |   |   |   |   |   |
| 1366 | <b>Recommended UCL exceeds the maximum observation</b>                                                                                   |        |   |                                 |        |   |   |   |   |   |   |
| 1367 |                                                                                                                                          |        |   |                                 |        |   |   |   |   |   |   |
| 1368 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |   |                                 |        |   |   |   |   |   |   |
| 1369 | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |   |                                 |        |   |   |   |   |   |   |
| 1370 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |   |                                 |        |   |   |   |   |   |   |
| 1371 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |   |                                 |        |   |   |   |   |   |   |
| 1372 |                                                                                                                                          |        |   |                                 |        |   |   |   |   |   |   |
| 1373 | <b>Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be</b>                 |        |   |                                 |        |   |   |   |   |   |   |
| 1374 | <b>reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.</b>                                       |        |   |                                 |        |   |   |   |   |   |   |
| 1375 |                                                                                                                                          |        |   |                                 |        |   |   |   |   |   |   |
| 1376 | <b>Result (grousemuscle_cobalt)</b>                                                                                                      |        |   |                                 |        |   |   |   |   |   |   |
| 1377 |                                                                                                                                          |        |   |                                 |        |   |   |   |   |   |   |
| 1378 | <b>General Statistics</b>                                                                                                                |        |   |                                 |        |   |   |   |   |   |   |
| 1379 | Total Number of Observations                                                                                                             | 3      |   | Number of Distinct Observations | 3      |   |   |   |   |   |   |
| 1380 | Number of Detects                                                                                                                        | 0      |   | Number of Non-Detects           | 3      |   |   |   |   |   |   |
| 1381 | Number of Distinct Detects                                                                                                               | 0      |   | Number of Distinct Non-Detects  | 3      |   |   |   |   |   |   |
| 1382 |                                                                                                                                          |        |   |                                 |        |   |   |   |   |   |   |
| 1383 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                       |        |   |                                 |        |   |   |   |   |   |   |
| 1384 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>                 |        |   |                                 |        |   |   |   |   |   |   |
| 1385 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>        |        |   |                                 |        |   |   |   |   |   |   |
| 1386 |                                                                                                                                          |        |   |                                 |        |   |   |   |   |   |   |
| 1387 | <b>The data set for variable Result (grousemuscle_cobalt) was not processed!</b>                                                         |        |   |                                 |        |   |   |   |   |   |   |
| 1388 |                                                                                                                                          |        |   |                                 |        |   |   |   |   |   |   |
| 1389 |                                                                                                                                          |        |   |                                 |        |   |   |   |   |   |   |
| 1390 | <b>Result (grousemuscle_iron)</b>                                                                                                        |        |   |                                 |        |   |   |   |   |   |   |
| 1391 |                                                                                                                                          |        |   |                                 |        |   |   |   |   |   |   |
| 1392 | <b>General Statistics</b>                                                                                                                |        |   |                                 |        |   |   |   |   |   |   |
| 1393 | Total Number of Observations                                                                                                             | 3      |   | Number of Distinct Observations | 3      |   |   |   |   |   |   |
| 1394 | Number of Detects                                                                                                                        | 0      |   | Number of Non-Detects           | 3      |   |   |   |   |   |   |
| 1395 | Number of Distinct Detects                                                                                                               | 0      |   | Number of Distinct Non-Detects  | 3      |   |   |   |   |   |   |
| 1396 |                                                                                                                                          |        |   |                                 |        |   |   |   |   |   |   |
| 1397 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                       |        |   |                                 |        |   |   |   |   |   |   |
| 1398 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>                 |        |   |                                 |        |   |   |   |   |   |   |
| 1399 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>        |        |   |                                 |        |   |   |   |   |   |   |
| 1400 |                                                                                                                                          |        |   |                                 |        |   |   |   |   |   |   |
| 1401 | <b>The data set for variable Result (grousemuscle_iron) was not processed!</b>                                                           |        |   |                                 |        |   |   |   |   |   |   |
| 1402 |                                                                                                                                          |        |   |                                 |        |   |   |   |   |   |   |
| 1403 |                                                                                                                                          |        |   |                                 |        |   |   |   |   |   |   |
| 1404 | <b>Result (grousemuscle_manganese)</b>                                                                                                   |        |   |                                 |        |   |   |   |   |   |   |
| 1405 |                                                                                                                                          |        |   |                                 |        |   |   |   |   |   |   |
| 1406 | <b>General Statistics</b>                                                                                                                |        |   |                                 |        |   |   |   |   |   |   |
| 1407 | Total Number of Observations                                                                                                             | 3      |   | Number of Distinct Observations | 3      |   |   |   |   |   |   |

| A    | B                                                                                                                                 | C | D | E | F       | G                                           | H | I | J | K       | L |
|------|-----------------------------------------------------------------------------------------------------------------------------------|---|---|---|---------|---------------------------------------------|---|---|---|---------|---|
| 1408 | Number of Detects                                                                                                                 |   |   |   | 0       | Number of Non-Detects                       |   |   |   | 3       |   |
| 1409 | Number of Distinct Detects                                                                                                        |   |   |   | 0       | Number of Distinct Non-Detects              |   |   |   | 3       |   |
| 1410 |                                                                                                                                   |   |   |   |         |                                             |   |   |   |         |   |
| 1411 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                |   |   |   |         |                                             |   |   |   |         |   |
| 1412 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>          |   |   |   |         |                                             |   |   |   |         |   |
| 1413 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b> |   |   |   |         |                                             |   |   |   |         |   |
| 1414 |                                                                                                                                   |   |   |   |         |                                             |   |   |   |         |   |
| 1415 | <b>The data set for variable Result (grousemuscle_manganese) was not processed!</b>                                               |   |   |   |         |                                             |   |   |   |         |   |
| 1416 |                                                                                                                                   |   |   |   |         |                                             |   |   |   |         |   |
| 1417 |                                                                                                                                   |   |   |   |         |                                             |   |   |   |         |   |
| 1418 | <b>Result (grousemuscle_mercury)</b>                                                                                              |   |   |   |         |                                             |   |   |   |         |   |
| 1419 |                                                                                                                                   |   |   |   |         |                                             |   |   |   |         |   |
| 1420 | <b>General Statistics</b>                                                                                                         |   |   |   |         |                                             |   |   |   |         |   |
| 1421 | Total Number of Observations                                                                                                      |   |   |   | 3       | Number of Distinct Observations             |   |   |   | 3       |   |
| 1422 | Number of Detects                                                                                                                 |   |   |   | 0       | Number of Non-Detects                       |   |   |   | 3       |   |
| 1423 | Number of Distinct Detects                                                                                                        |   |   |   | 0       | Number of Distinct Non-Detects              |   |   |   | 3       |   |
| 1424 |                                                                                                                                   |   |   |   |         |                                             |   |   |   |         |   |
| 1425 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                |   |   |   |         |                                             |   |   |   |         |   |
| 1426 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>          |   |   |   |         |                                             |   |   |   |         |   |
| 1427 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b> |   |   |   |         |                                             |   |   |   |         |   |
| 1428 |                                                                                                                                   |   |   |   |         |                                             |   |   |   |         |   |
| 1429 | <b>The data set for variable Result (grousemuscle_mercury) was not processed!</b>                                                 |   |   |   |         |                                             |   |   |   |         |   |
| 1430 |                                                                                                                                   |   |   |   |         |                                             |   |   |   |         |   |
| 1431 |                                                                                                                                   |   |   |   |         |                                             |   |   |   |         |   |
| 1432 | <b>Result (grousemuscle_thallium)</b>                                                                                             |   |   |   |         |                                             |   |   |   |         |   |
| 1433 |                                                                                                                                   |   |   |   |         |                                             |   |   |   |         |   |
| 1434 | <b>General Statistics</b>                                                                                                         |   |   |   |         |                                             |   |   |   |         |   |
| 1435 | Total Number of Observations                                                                                                      |   |   |   | 3       | Number of Distinct Observations             |   |   |   | 3       |   |
| 1436 | Number of Detects                                                                                                                 |   |   |   | 0       | Number of Non-Detects                       |   |   |   | 3       |   |
| 1437 | Number of Distinct Detects                                                                                                        |   |   |   | 0       | Number of Distinct Non-Detects              |   |   |   | 3       |   |
| 1438 |                                                                                                                                   |   |   |   |         |                                             |   |   |   |         |   |
| 1439 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                |   |   |   |         |                                             |   |   |   |         |   |
| 1440 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>          |   |   |   |         |                                             |   |   |   |         |   |
| 1441 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b> |   |   |   |         |                                             |   |   |   |         |   |
| 1442 |                                                                                                                                   |   |   |   |         |                                             |   |   |   |         |   |
| 1443 | <b>The data set for variable Result (grousemuscle_thallium) was not processed!</b>                                                |   |   |   |         |                                             |   |   |   |         |   |
| 1444 |                                                                                                                                   |   |   |   |         |                                             |   |   |   |         |   |
| 1445 |                                                                                                                                   |   |   |   |         |                                             |   |   |   |         |   |
| 1446 |                                                                                                                                   |   |   |   |         |                                             |   |   |   |         |   |
| 1447 | <b>Result (grousemuscle_zinc)</b>                                                                                                 |   |   |   |         |                                             |   |   |   |         |   |
| 1448 |                                                                                                                                   |   |   |   |         |                                             |   |   |   |         |   |
| 1449 | <b>General Statistics</b>                                                                                                         |   |   |   |         |                                             |   |   |   |         |   |
| 1450 | Total Number of Observations                                                                                                      |   |   |   | 3       | Number of Distinct Observations             |   |   |   | 3       |   |
| 1451 |                                                                                                                                   |   |   |   |         | Number of Missing Observations              |   |   |   | 0       |   |
| 1452 | Minimum                                                                                                                           |   |   |   | 4.824   | Mean                                        |   |   |   | 4.859   |   |
| 1453 | Maximum                                                                                                                           |   |   |   | 4.895   | Median                                      |   |   |   | 4.859   |   |
| 1454 | SD                                                                                                                                |   |   |   | 0.0355  | Std. Error of Mean                          |   |   |   | 0.0205  |   |
| 1455 | Coefficient of Variation                                                                                                          |   |   |   | 0.00731 | Skewness                                    |   |   |   | 0.00845 |   |
| 1456 |                                                                                                                                   |   |   |   |         |                                             |   |   |   |         |   |
| 1457 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                        |   |   |   |         |                                             |   |   |   |         |   |
| 1458 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                            |   |   |   |         |                                             |   |   |   |         |   |
| 1459 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                               |   |   |   |         |                                             |   |   |   |         |   |
| 1460 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                    |   |   |   |         |                                             |   |   |   |         |   |
| 1461 |                                                                                                                                   |   |   |   |         |                                             |   |   |   |         |   |
| 1462 | <b>Normal GOF Test</b>                                                                                                            |   |   |   |         |                                             |   |   |   |         |   |
| 1463 | Shapiro Wilk Test Statistic                                                                                                       |   |   |   | 1       | <b>Shapiro Wilk GOF Test</b>                |   |   |   |         |   |
| 1464 | 5% Shapiro Wilk Critical Value                                                                                                    |   |   |   | 0.767   | Data appear Normal at 5% Significance Level |   |   |   |         |   |
| 1465 | Lilliefors Test Statistic                                                                                                         |   |   |   | 0.175   | <b>Lilliefors GOF Test</b>                  |   |   |   |         |   |
| 1466 | 5% Lilliefors Critical Value                                                                                                      |   |   |   | 0.425   | Data appear Normal at 5% Significance Level |   |   |   |         |   |
| 1467 | <b>Data appear Normal at 5% Significance Level</b>                                                                                |   |   |   |         |                                             |   |   |   |         |   |
| 1468 |                                                                                                                                   |   |   |   |         |                                             |   |   |   |         |   |
| 1469 | <b>Assuming Normal Distribution</b>                                                                                               |   |   |   |         |                                             |   |   |   |         |   |
| 1470 | <b>95% Normal UCL</b>                                                                                                             |   |   |   |         | <b>95% UCLs (Adjusted for Skewness)</b>     |   |   |   |         |   |
| 1471 | 95% Student's-t UCL                                                                                                               |   |   |   | 4.919   | 95% Adjusted-CLT UCL (Chen-1995)            |   |   |   | 4.893   |   |
| 1472 |                                                                                                                                   |   |   |   |         | 95% Modified-t UCL (Johnson-1978)           |   |   |   | 4.919   |   |
| 1473 |                                                                                                                                   |   |   |   |         |                                             |   |   |   |         |   |
| 1474 | <b>Gamma GOF Test</b>                                                                                                             |   |   |   |         |                                             |   |   |   |         |   |

| A    | B                                                                                                                                        | C         | D | E                                              | F       | G | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|-----------|---|------------------------------------------------|---------|---|---|---|---|---|---|
| 1475 | <b>Not Enough Data to Perform GOF Test</b>                                                                                               |           |   |                                                |         |   |   |   |   |   |   |
| 1476 |                                                                                                                                          |           |   |                                                |         |   |   |   |   |   |   |
| 1477 | <b>Gamma Statistics</b>                                                                                                                  |           |   |                                                |         |   |   |   |   |   |   |
| 1478 | k hat (MLE)                                                                                                                              | 28107     |   | k star (bias corrected MLE)                    | N/A     |   |   |   |   |   |   |
| 1479 | Theta hat (MLE)                                                                                                                          | 1.7289E-4 |   | Theta star (bias corrected MLE)                | N/A     |   |   |   |   |   |   |
| 1480 | nu hat (MLE)                                                                                                                             | 168639    |   | nu star (bias corrected)                       | N/A     |   |   |   |   |   |   |
| 1481 | MLE Mean (bias corrected)                                                                                                                | N/A       |   | MLE Sd (bias corrected)                        | N/A     |   |   |   |   |   |   |
| 1482 |                                                                                                                                          |           |   | Approximate Chi Square Value (0.05)            | N/A     |   |   |   |   |   |   |
| 1483 | Adjusted Level of Significance                                                                                                           | N/A       |   | Adjusted Chi Square Value                      | N/A     |   |   |   |   |   |   |
| 1484 |                                                                                                                                          |           |   |                                                |         |   |   |   |   |   |   |
| 1485 | <b>Assuming Gamma Distribution</b>                                                                                                       |           |   |                                                |         |   |   |   |   |   |   |
| 1486 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | N/A       |   | 95% Adjusted Gamma UCL (use when n<50)         | N/A     |   |   |   |   |   |   |
| 1487 |                                                                                                                                          |           |   |                                                |         |   |   |   |   |   |   |
| 1488 | <b>Lognormal GOF Test</b>                                                                                                                |           |   |                                                |         |   |   |   |   |   |   |
| 1489 | Shapiro Wilk Test Statistic                                                                                                              | 1         |   | <b>Shapiro Wilk Lognormal GOF Test</b>         |         |   |   |   |   |   |   |
| 1490 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.767     |   | Data appear Lognormal at 5% Significance Level |         |   |   |   |   |   |   |
| 1491 | Lilliefors Test Statistic                                                                                                                | 0.175     |   | <b>Lilliefors Lognormal GOF Test</b>           |         |   |   |   |   |   |   |
| 1492 | 5% Lilliefors Critical Value                                                                                                             | 0.425     |   | Data appear Lognormal at 5% Significance Level |         |   |   |   |   |   |   |
| 1493 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |           |   |                                                |         |   |   |   |   |   |   |
| 1494 |                                                                                                                                          |           |   |                                                |         |   |   |   |   |   |   |
| 1495 | <b>Lognormal Statistics</b>                                                                                                              |           |   |                                                |         |   |   |   |   |   |   |
| 1496 | Minimum of Logged Data                                                                                                                   | 1.574     |   | Mean of logged Data                            | 1.581   |   |   |   |   |   |   |
| 1497 | Maximum of Logged Data                                                                                                                   | 1.588     |   | SD of logged Data                              | 0.00731 |   |   |   |   |   |   |
| 1498 |                                                                                                                                          |           |   |                                                |         |   |   |   |   |   |   |
| 1499 | <b>Assuming Lognormal Distribution</b>                                                                                                   |           |   |                                                |         |   |   |   |   |   |   |
| 1500 | 95% H-UCL                                                                                                                                | N/A       |   | 90% Chebyshev (MVUE) UCL                       | 4.921   |   |   |   |   |   |   |
| 1501 | 95% Chebyshev (MVUE) UCL                                                                                                                 | 4.949     |   | 97.5% Chebyshev (MVUE) UCL                     | 4.987   |   |   |   |   |   |   |
| 1502 | 99% Chebyshev (MVUE) UCL                                                                                                                 | 5.063     |   |                                                |         |   |   |   |   |   |   |
| 1503 |                                                                                                                                          |           |   |                                                |         |   |   |   |   |   |   |
| 1504 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |           |   |                                                |         |   |   |   |   |   |   |
| 1505 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |           |   |                                                |         |   |   |   |   |   |   |
| 1506 |                                                                                                                                          |           |   |                                                |         |   |   |   |   |   |   |
| 1507 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |           |   |                                                |         |   |   |   |   |   |   |
| 1508 | 95% CLT UCL                                                                                                                              | 4.893     |   | 95% Jackknife UCL                              | 4.919   |   |   |   |   |   |   |
| 1509 | 95% Standard Bootstrap UCL                                                                                                               | N/A       |   | 95% Bootstrap-t UCL                            | N/A     |   |   |   |   |   |   |
| 1510 | 95% Hall's Bootstrap UCL                                                                                                                 | N/A       |   | 95% Percentile Bootstrap UCL                   | N/A     |   |   |   |   |   |   |
| 1511 | 95% BCA Bootstrap UCL                                                                                                                    | N/A       |   |                                                |         |   |   |   |   |   |   |
| 1512 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              | 4.921     |   | 95% Chebyshev(Mean, Sd) UCL                    | 4.949   |   |   |   |   |   |   |
| 1513 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            | 4.987     |   | 99% Chebyshev(Mean, Sd) UCL                    | 5.063   |   |   |   |   |   |   |
| 1514 |                                                                                                                                          |           |   |                                                |         |   |   |   |   |   |   |
| 1515 | <b>Suggested UCL to Use</b>                                                                                                              |           |   |                                                |         |   |   |   |   |   |   |
| 1516 | 95% Student's-t UCL                                                                                                                      | 4.919     |   |                                                |         |   |   |   |   |   |   |
| 1517 |                                                                                                                                          |           |   |                                                |         |   |   |   |   |   |   |
| 1518 | <b>Recommended UCL exceeds the maximum observation</b>                                                                                   |           |   |                                                |         |   |   |   |   |   |   |
| 1519 |                                                                                                                                          |           |   |                                                |         |   |   |   |   |   |   |
| 1520 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |           |   |                                                |         |   |   |   |   |   |   |
| 1521 | Recommendations are based upon data size, data distribution, and skewness.                                                               |           |   |                                                |         |   |   |   |   |   |   |
| 1522 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |           |   |                                                |         |   |   |   |   |   |   |
| 1523 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |           |   |                                                |         |   |   |   |   |   |   |
| 1524 |                                                                                                                                          |           |   |                                                |         |   |   |   |   |   |   |
| 1525 | <b>Result (grouseorgan_antimony)</b>                                                                                                     |           |   |                                                |         |   |   |   |   |   |   |
| 1526 |                                                                                                                                          |           |   |                                                |         |   |   |   |   |   |   |
| 1527 | <b>General Statistics</b>                                                                                                                |           |   |                                                |         |   |   |   |   |   |   |
| 1528 | Total Number of Observations                                                                                                             | 9         |   | Number of Distinct Observations                | 9       |   |   |   |   |   |   |
| 1529 | Number of Detects                                                                                                                        | 0         |   | Number of Non-Detects                          | 9       |   |   |   |   |   |   |
| 1530 | Number of Distinct Detects                                                                                                               | 0         |   | Number of Distinct Non-Detects                 | 9       |   |   |   |   |   |   |
| 1531 |                                                                                                                                          |           |   |                                                |         |   |   |   |   |   |   |
| 1532 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                       |           |   |                                                |         |   |   |   |   |   |   |
| 1533 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>                 |           |   |                                                |         |   |   |   |   |   |   |
| 1534 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>        |           |   |                                                |         |   |   |   |   |   |   |
| 1535 |                                                                                                                                          |           |   |                                                |         |   |   |   |   |   |   |
| 1536 | <b>The data set for variable Result (grouseorgan_antimony) was not processed!</b>                                                        |           |   |                                                |         |   |   |   |   |   |   |
| 1537 |                                                                                                                                          |           |   |                                                |         |   |   |   |   |   |   |
| 1538 |                                                                                                                                          |           |   |                                                |         |   |   |   |   |   |   |
| 1539 | <b>Result (grouseorgan_arsenic)</b>                                                                                                      |           |   |                                                |         |   |   |   |   |   |   |
| 1540 |                                                                                                                                          |           |   |                                                |         |   |   |   |   |   |   |
| 1541 | <b>General Statistics</b>                                                                                                                |           |   |                                                |         |   |   |   |   |   |   |

|      | A                                                                                                                                 | B | C | D | E      | F                                                               | G | H | I | J      | K | L |
|------|-----------------------------------------------------------------------------------------------------------------------------------|---|---|---|--------|-----------------------------------------------------------------|---|---|---|--------|---|---|
| 1542 | Total Number of Observations                                                                                                      |   |   |   | 9      | Number of Distinct Observations                                 |   |   |   | 9      |   |   |
| 1543 | Number of Detects                                                                                                                 |   |   |   | 0      | Number of Non-Detects                                           |   |   |   | 9      |   |   |
| 1544 | Number of Distinct Detects                                                                                                        |   |   |   | 0      | Number of Distinct Non-Detects                                  |   |   |   | 9      |   |   |
| 1545 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1546 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1547 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>          |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1548 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b> |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1549 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1550 | <b>The data set for variable Result (grouseorgan_arsenic) was not processed!</b>                                                  |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1551 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1552 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1553 | <b>Result (grouseorgan_cadmium)</b>                                                                                               |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1554 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1555 | <b>General Statistics</b>                                                                                                         |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1556 | Total Number of Observations                                                                                                      |   |   |   | 9      | Number of Distinct Observations                                 |   |   |   | 9      |   |   |
| 1557 | Number of Detects                                                                                                                 |   |   |   | 8      | Number of Non-Detects                                           |   |   |   | 1      |   |   |
| 1558 | Number of Distinct Detects                                                                                                        |   |   |   | 8      | Number of Distinct Non-Detects                                  |   |   |   | 1      |   |   |
| 1559 | Minimum Detect                                                                                                                    |   |   |   | 0.0215 | Minimum Non-Detect                                              |   |   |   | 0.0102 |   |   |
| 1560 | Maximum Detect                                                                                                                    |   |   |   | 5.29   | Maximum Non-Detect                                              |   |   |   | 0.0102 |   |   |
| 1561 | Variance Detects                                                                                                                  |   |   |   | 4.325  | Percent Non-Detects                                             |   |   |   | 11.11% |   |   |
| 1562 | Mean Detects                                                                                                                      |   |   |   | 1.62   | SD Detects                                                      |   |   |   | 2.08   |   |   |
| 1563 | Median Detects                                                                                                                    |   |   |   | 0.823  | CV Detects                                                      |   |   |   | 1.284  |   |   |
| 1564 | Skewness Detects                                                                                                                  |   |   |   | 1.334  | Kurtosis Detects                                                |   |   |   | 0.0632 |   |   |
| 1565 | Mean of Logged Detects                                                                                                            |   |   |   | -0.728 | SD of Logged Detects                                            |   |   |   | 2.114  |   |   |
| 1566 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1567 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                        |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1568 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                            |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1569 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                               |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1570 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                    |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1571 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1572 | <b>Normal GOF Test on Detects Only</b>                                                                                            |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1573 | Shapiro Wilk Test Statistic                                                                                                       |   |   |   | 0.746  | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |        |   |   |
| 1574 | 5% Shapiro Wilk Critical Value                                                                                                    |   |   |   | 0.818  | Detected Data Not Normal at 5% Significance Level               |   |   |   |        |   |   |
| 1575 | Lilliefors Test Statistic                                                                                                         |   |   |   | 0.352  | <b>Lilliefors GOF Test</b>                                      |   |   |   |        |   |   |
| 1576 | 5% Lilliefors Critical Value                                                                                                      |   |   |   | 0.283  | Detected Data Not Normal at 5% Significance Level               |   |   |   |        |   |   |
| 1577 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                          |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1578 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1579 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                     |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1580 | KM Mean                                                                                                                           |   |   |   | 1.441  | KM Standard Error of Mean                                       |   |   |   | 0.678  |   |   |
| 1581 | KM SD                                                                                                                             |   |   |   | 1.903  | 95% KM (BCA) UCL                                                |   |   |   | 2.504  |   |   |
| 1582 | 95% KM (t) UCL                                                                                                                    |   |   |   | 2.702  | 95% KM (Percentile Bootstrap) UCL                               |   |   |   | 2.528  |   |   |
| 1583 | 95% KM (z) UCL                                                                                                                    |   |   |   | 2.556  | 95% KM Bootstrap t UCL                                          |   |   |   | 5.832  |   |   |
| 1584 | 90% KM Chebyshev UCL                                                                                                              |   |   |   | 3.475  | 95% KM Chebyshev UCL                                            |   |   |   | 4.396  |   |   |
| 1585 | 97.5% KM Chebyshev UCL                                                                                                            |   |   |   | 5.675  | 99% KM Chebyshev UCL                                            |   |   |   | 8.187  |   |   |
| 1586 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1587 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                              |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1588 | A-D Test Statistic                                                                                                                |   |   |   | 0.361  | <b>Anderson-Darling GOF Test</b>                                |   |   |   |        |   |   |
| 1589 | 5% A-D Critical Value                                                                                                             |   |   |   | 0.761  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |        |   |   |
| 1590 | K-S Test Statistic                                                                                                                |   |   |   | 0.17   | <b>Kolmogorov-Smirnov GOF</b>                                   |   |   |   |        |   |   |
| 1591 | 5% K-S Critical Value                                                                                                             |   |   |   | 0.309  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |        |   |   |
| 1592 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                            |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1593 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1594 | <b>Gamma Statistics on Detected Data Only</b>                                                                                     |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1595 | k hat (MLE)                                                                                                                       |   |   |   | 0.521  | k star (bias corrected MLE)                                     |   |   |   | 0.409  |   |   |
| 1596 | Theta hat (MLE)                                                                                                                   |   |   |   | 3.107  | Theta star (bias corrected MLE)                                 |   |   |   | 3.958  |   |   |
| 1597 | nu hat (MLE)                                                                                                                      |   |   |   | 8.343  | nu star (bias corrected)                                        |   |   |   | 6.548  |   |   |
| 1598 | Mean (detects)                                                                                                                    |   |   |   | 1.62   |                                                                 |   |   |   |        |   |   |
| 1599 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1600 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                             |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1601 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                      |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1602 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)         |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1603 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                      |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1604 | This is especially true when the sample size is small.                                                                            |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1605 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                       |   |   |   |        |                                                                 |   |   |   |        |   |   |
| 1606 | Minimum                                                                                                                           |   |   |   | 0.01   | Mean                                                            |   |   |   | 1.441  |   |   |
| 1607 | Maximum                                                                                                                           |   |   |   | 5.29   | Median                                                          |   |   |   | 0.76   |   |   |
| 1608 | SD                                                                                                                                |   |   |   | 2.018  | CV                                                              |   |   |   | 1.4    |   |   |

|      | A                                                                                                                                        | B | C | D | E                                                   | F      | G                           | H | I | J                                                                | K | L      |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|-----------------------------------------------------|--------|-----------------------------|---|---|------------------------------------------------------------------|---|--------|
| 1609 |                                                                                                                                          |   |   |   | k hat (MLE)                                         | 0.427  |                             |   |   | k star (bias corrected MLE)                                      |   | 0.359  |
| 1610 |                                                                                                                                          |   |   |   | Theta hat (MLE)                                     | 3.373  |                             |   |   | Theta star (bias corrected MLE)                                  |   | 4.015  |
| 1611 |                                                                                                                                          |   |   |   | nu hat (MLE)                                        | 7.69   |                             |   |   | nu star (bias corrected)                                         |   | 6.46   |
| 1612 |                                                                                                                                          |   |   |   | Adjusted Level of Significance ( $\beta$ )          | 0.0231 |                             |   |   |                                                                  |   |        |
| 1613 |                                                                                                                                          |   |   |   | Approximate Chi Square Value (6.46, $\alpha$ )      | 1.879  |                             |   |   | Adjusted Chi Square Value (6.46, $\beta$ )                       |   | 1.405  |
| 1614 |                                                                                                                                          |   |   |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )   | 4.953  |                             |   |   | 95% Gamma Adjusted UCL (use when $n < 50$ )                      |   | 6.625  |
| 1615 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1616 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1617 |                                                                                                                                          |   |   |   | Mean (KM)                                           | 1.441  |                             |   |   | SD (KM)                                                          |   | 1.903  |
| 1618 |                                                                                                                                          |   |   |   | Variance (KM)                                       | 3.62   |                             |   |   | SE of Mean (KM)                                                  |   | 0.678  |
| 1619 |                                                                                                                                          |   |   |   | k hat (KM)                                          | 0.574  |                             |   |   | k star (KM)                                                      |   | 0.457  |
| 1620 |                                                                                                                                          |   |   |   | nu hat (KM)                                         | 10.33  |                             |   |   | nu star (KM)                                                     |   | 8.218  |
| 1621 |                                                                                                                                          |   |   |   | theta hat (KM)                                      | 2.512  |                             |   |   | theta star (KM)                                                  |   | 3.156  |
| 1622 |                                                                                                                                          |   |   |   | 80% gamma percentile (KM)                           | 2.354  |                             |   |   | 90% gamma percentile (KM)                                        |   | 3.971  |
| 1623 |                                                                                                                                          |   |   |   | 95% gamma percentile (KM)                           | 5.717  |                             |   |   | 99% gamma percentile (KM)                                        |   | 10.05  |
| 1624 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1625 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1626 |                                                                                                                                          |   |   |   | Approximate Chi Square Value (8.22, $\alpha$ )      | 2.862  |                             |   |   | Adjusted Chi Square Value (8.22, $\beta$ )                       |   | 2.239  |
| 1627 |                                                                                                                                          |   |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ ) | 4.138  |                             |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )                   |   | 5.29   |
| 1628 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1629 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1630 |                                                                                                                                          |   |   |   | Shapiro Wilk Test Statistic                         | 0.871  |                             |   |   | <b>Shapiro Wilk GOF Test</b>                                     |   |        |
| 1631 |                                                                                                                                          |   |   |   | 5% Shapiro Wilk Critical Value                      | 0.818  |                             |   |   | Detected Data appear Lognormal at 5% Significance Level          |   |        |
| 1632 |                                                                                                                                          |   |   |   | Lilliefors Test Statistic                           | 0.21   |                             |   |   | <b>Lilliefors GOF Test</b>                                       |   |        |
| 1633 |                                                                                                                                          |   |   |   | 5% Lilliefors Critical Value                        | 0.283  |                             |   |   | Detected Data appear Lognormal at 5% Significance Level          |   |        |
| 1634 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                           |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1635 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1636 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1637 |                                                                                                                                          |   |   |   | Mean in Original Scale                              | 1.44   |                             |   |   | Mean in Log Scale                                                |   | -1.282 |
| 1638 |                                                                                                                                          |   |   |   | SD in Original Scale                                | 2.019  |                             |   |   | SD in Log Scale                                                  |   | 2.584  |
| 1639 |                                                                                                                                          |   |   |   | 95% t UCL (assumes normality of ROS data)           | 2.691  |                             |   |   | 95% Percentile Bootstrap UCL                                     |   | 2.532  |
| 1640 |                                                                                                                                          |   |   |   | 95% BCA Bootstrap UCL                               | 2.848  |                             |   |   | 95% Bootstrap t UCL                                              |   | 6.071  |
| 1641 |                                                                                                                                          |   |   |   | 95% H-UCL (Log ROS)                                 | 5841   |                             |   |   |                                                                  |   |        |
| 1642 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1643 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1644 |                                                                                                                                          |   |   |   | KM Mean (logged)                                    | -1.156 |                             |   |   | KM Geo Mean                                                      |   | 0.315  |
| 1645 |                                                                                                                                          |   |   |   | KM SD (logged)                                      | 2.224  |                             |   |   | 95% Critical H Value (KM-Log)                                    |   | 6.293  |
| 1646 |                                                                                                                                          |   |   |   | KM Standard Error of Mean (logged)                  | 0.792  |                             |   |   | 95% H-UCL (KM -Log)                                              |   | 524.9  |
| 1647 |                                                                                                                                          |   |   |   | KM SD (logged)                                      | 2.224  |                             |   |   | 95% Critical H Value (KM-Log)                                    |   | 6.293  |
| 1648 |                                                                                                                                          |   |   |   | KM Standard Error of Mean (logged)                  | 0.792  |                             |   |   |                                                                  |   |        |
| 1649 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1650 | <b>DL/2 Statistics</b>                                                                                                                   |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1651 | <b>DL/2 Normal</b>                                                                                                                       |   |   |   |                                                     |        | <b>DL/2 Log-Transformed</b> |   |   |                                                                  |   |        |
| 1652 |                                                                                                                                          |   |   |   | Mean in Original Scale                              | 1.44   |                             |   |   | Mean in Log Scale                                                |   | -1.233 |
| 1653 |                                                                                                                                          |   |   |   | SD in Original Scale                                | 2.018  |                             |   |   | SD in Log Scale                                                  |   | 2.492  |
| 1654 |                                                                                                                                          |   |   |   | 95% t UCL (Assumes normality)                       | 2.692  |                             |   |   | 95% H-Stat UCL                                                   |   | 3099   |
| 1655 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1656 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1657 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1658 | <b>Detected Data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1659 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1660 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1661 |                                                                                                                                          |   |   |   | 95% KM Bootstrap t UCL                              | 5.832  |                             |   |   | d KM-UCL (use when $k \leq 1$ and $15 < n < 50$ but $k \leq 1$ ) |   | 5.29   |
| 1662 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1663 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1664 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1665 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1666 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1667 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1668 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1669 | <b>Result (grouseorgan_chromium)</b>                                                                                                     |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1670 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1671 | <b>General Statistics</b>                                                                                                                |   |   |   |                                                     |        |                             |   |   |                                                                  |   |        |
| 1672 |                                                                                                                                          |   |   |   | Total Number of Observations                        | 9      |                             |   |   | Number of Distinct Observations                                  |   | 9      |
| 1673 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   | Number of Missing Observations                                   |   | 0      |
| 1674 |                                                                                                                                          |   |   |   | Minimum                                             | 0.625  |                             |   |   | Mean                                                             |   | 0.691  |
| 1675 |                                                                                                                                          |   |   |   | Maximum                                             | 0.778  |                             |   |   | Median                                                           |   | 0.668  |

| A    | B | C | D | E                                                                                                          | F       | G | H | I                                       | J                                                               | K | L       |
|------|---|---|---|------------------------------------------------------------------------------------------------------------|---------|---|---|-----------------------------------------|-----------------------------------------------------------------|---|---------|
| 1676 |   |   |   | SD                                                                                                         | 0.0593  |   |   |                                         | Std. Error of Mean                                              |   | 0.0198  |
| 1677 |   |   |   | Coefficient of Variation                                                                                   | 0.0858  |   |   |                                         | Skewness                                                        |   | 0.563   |
| 1678 |   |   |   |                                                                                                            |         |   |   |                                         |                                                                 |   |         |
| 1679 |   |   |   | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b> |         |   |   |                                         |                                                                 |   |         |
| 1680 |   |   |   | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>     |         |   |   |                                         |                                                                 |   |         |
| 1681 |   |   |   | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                        |         |   |   |                                         |                                                                 |   |         |
| 1682 |   |   |   | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>             |         |   |   |                                         |                                                                 |   |         |
| 1683 |   |   |   |                                                                                                            |         |   |   |                                         |                                                                 |   |         |
| 1684 |   |   |   | <b>Normal GOF Test</b>                                                                                     |         |   |   |                                         |                                                                 |   |         |
| 1685 |   |   |   | Shapiro Wilk Test Statistic                                                                                | 0.86    |   |   |                                         | <b>Shapiro Wilk GOF Test</b>                                    |   |         |
| 1686 |   |   |   | 5% Shapiro Wilk Critical Value                                                                             | 0.829   |   |   |                                         | Data appear Normal at 5% Significance Level                     |   |         |
| 1687 |   |   |   | Lilliefors Test Statistic                                                                                  | 0.212   |   |   |                                         | <b>Lilliefors GOF Test</b>                                      |   |         |
| 1688 |   |   |   | 5% Lilliefors Critical Value                                                                               | 0.274   |   |   |                                         | Data appear Normal at 5% Significance Level                     |   |         |
| 1689 |   |   |   | <b>Data appear Normal at 5% Significance Level</b>                                                         |         |   |   |                                         |                                                                 |   |         |
| 1690 |   |   |   |                                                                                                            |         |   |   |                                         |                                                                 |   |         |
| 1691 |   |   |   | <b>Assuming Normal Distribution</b>                                                                        |         |   |   |                                         |                                                                 |   |         |
| 1692 |   |   |   | <b>95% Normal UCL</b>                                                                                      |         |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |                                                                 |   |         |
| 1693 |   |   |   | 95% Student's-t UCL                                                                                        | 0.728   |   |   |                                         | 95% Adjusted-CLT UCL (Chen-1995)                                |   | 0.728   |
| 1694 |   |   |   |                                                                                                            |         |   |   |                                         | 95% Modified-t UCL (Johnson-1978)                               |   | 0.729   |
| 1695 |   |   |   |                                                                                                            |         |   |   |                                         |                                                                 |   |         |
| 1696 |   |   |   | <b>Gamma GOF Test</b>                                                                                      |         |   |   |                                         |                                                                 |   |         |
| 1697 |   |   |   | A-D Test Statistic                                                                                         | 0.623   |   |   |                                         | <b>Anderson-Darling Gamma GOF Test</b>                          |   |         |
| 1698 |   |   |   | 5% A-D Critical Value                                                                                      | 0.72    |   |   |                                         | Detected data appear Gamma Distributed at 5% Significance Level |   |         |
| 1699 |   |   |   | K-S Test Statistic                                                                                         | 0.218   |   |   |                                         | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |         |
| 1700 |   |   |   | 5% K-S Critical Value                                                                                      | 0.279   |   |   |                                         | Detected data appear Gamma Distributed at 5% Significance Level |   |         |
| 1701 |   |   |   | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                     |         |   |   |                                         |                                                                 |   |         |
| 1702 |   |   |   |                                                                                                            |         |   |   |                                         |                                                                 |   |         |
| 1703 |   |   |   | <b>Gamma Statistics</b>                                                                                    |         |   |   |                                         |                                                                 |   |         |
| 1704 |   |   |   | k hat (MLE)                                                                                                | 156.3   |   |   |                                         | k star (bias corrected MLE)                                     |   | 104.3   |
| 1705 |   |   |   | Theta hat (MLE)                                                                                            | 0.00442 |   |   |                                         | Theta star (bias corrected MLE)                                 |   | 0.00663 |
| 1706 |   |   |   | nu hat (MLE)                                                                                               | 2813    |   |   |                                         | nu star (bias corrected)                                        |   | 1877    |
| 1707 |   |   |   | MLE Mean (bias corrected)                                                                                  | 0.691   |   |   |                                         | MLE Sd (bias corrected)                                         |   | 0.0677  |
| 1708 |   |   |   |                                                                                                            |         |   |   |                                         | Approximate Chi Square Value (0.05)                             |   | 1777    |
| 1709 |   |   |   | Adjusted Level of Significance                                                                             | 0.0231  |   |   |                                         | Adjusted Chi Square Value                                       |   | 1756    |
| 1710 |   |   |   |                                                                                                            |         |   |   |                                         |                                                                 |   |         |
| 1711 |   |   |   | <b>Assuming Gamma Distribution</b>                                                                         |         |   |   |                                         |                                                                 |   |         |
| 1712 |   |   |   | 95% Approximate Gamma UCL (use when n>=50))                                                                | 0.73    |   |   |                                         | 95% Adjusted Gamma UCL (use when n<50)                          |   | 0.739   |
| 1713 |   |   |   |                                                                                                            |         |   |   |                                         |                                                                 |   |         |
| 1714 |   |   |   | <b>Lognormal GOF Test</b>                                                                                  |         |   |   |                                         |                                                                 |   |         |
| 1715 |   |   |   | Shapiro Wilk Test Statistic                                                                                | 0.869   |   |   |                                         | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |         |
| 1716 |   |   |   | 5% Shapiro Wilk Critical Value                                                                             | 0.829   |   |   |                                         | Data appear Lognormal at 5% Significance Level                  |   |         |
| 1717 |   |   |   | Lilliefors Test Statistic                                                                                  | 0.204   |   |   |                                         | <b>Lilliefors Lognormal GOF Test</b>                            |   |         |
| 1718 |   |   |   | 5% Lilliefors Critical Value                                                                               | 0.274   |   |   |                                         | Data appear Lognormal at 5% Significance Level                  |   |         |
| 1719 |   |   |   | <b>Data appear Lognormal at 5% Significance Level</b>                                                      |         |   |   |                                         |                                                                 |   |         |
| 1720 |   |   |   |                                                                                                            |         |   |   |                                         |                                                                 |   |         |
| 1721 |   |   |   | <b>Lognormal Statistics</b>                                                                                |         |   |   |                                         |                                                                 |   |         |
| 1722 |   |   |   | Minimum of Logged Data                                                                                     | -0.47   |   |   |                                         | Mean of logged Data                                             |   | -0.372  |
| 1723 |   |   |   | Maximum of Logged Data                                                                                     | -0.252  |   |   |                                         | SD of logged Data                                               |   | 0.0845  |
| 1724 |   |   |   |                                                                                                            |         |   |   |                                         |                                                                 |   |         |
| 1725 |   |   |   | <b>Assuming Lognormal Distribution</b>                                                                     |         |   |   |                                         |                                                                 |   |         |
| 1726 |   |   |   | 95% H-UCL                                                                                                  | N/A     |   |   |                                         | 90% Chebyshev (MVUE) UCL                                        |   | 0.75    |
| 1727 |   |   |   | 95% Chebyshev (MVUE) UCL                                                                                   | 0.776   |   |   |                                         | 97.5% Chebyshev (MVUE) UCL                                      |   | 0.813   |
| 1728 |   |   |   | 99% Chebyshev (MVUE) UCL                                                                                   | 0.885   |   |   |                                         |                                                                 |   |         |
| 1729 |   |   |   |                                                                                                            |         |   |   |                                         |                                                                 |   |         |
| 1730 |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                      |         |   |   |                                         |                                                                 |   |         |
| 1731 |   |   |   | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                           |         |   |   |                                         |                                                                 |   |         |
| 1732 |   |   |   |                                                                                                            |         |   |   |                                         |                                                                 |   |         |
| 1733 |   |   |   | <b>Nonparametric Distribution Free UCLs</b>                                                                |         |   |   |                                         |                                                                 |   |         |
| 1734 |   |   |   | 95% CLT UCL                                                                                                | 0.724   |   |   |                                         | 95% Jackknife UCL                                               |   | 0.728   |
| 1735 |   |   |   | 95% Standard Bootstrap UCL                                                                                 | 0.722   |   |   |                                         | 95% Bootstrap-t UCL                                             |   | 0.734   |
| 1736 |   |   |   | 95% Hall's Bootstrap UCL                                                                                   | 0.717   |   |   |                                         | 95% Percentile Bootstrap UCL                                    |   | 0.723   |
| 1737 |   |   |   | 95% BCA Bootstrap UCL                                                                                      | 0.727   |   |   |                                         |                                                                 |   |         |
| 1738 |   |   |   | 90% Chebyshev(Mean, Sd) UCL                                                                                | 0.751   |   |   |                                         | 95% Chebyshev(Mean, Sd) UCL                                     |   | 0.778   |
| 1739 |   |   |   | 97.5% Chebyshev(Mean, Sd) UCL                                                                              | 0.815   |   |   |                                         | 99% Chebyshev(Mean, Sd) UCL                                     |   | 0.888   |
| 1740 |   |   |   |                                                                                                            |         |   |   |                                         |                                                                 |   |         |
| 1741 |   |   |   | <b>Suggested UCL to Use</b>                                                                                |         |   |   |                                         |                                                                 |   |         |
| 1742 |   |   |   | 95% Student's-t UCL                                                                                        | 0.728   |   |   |                                         |                                                                 |   |         |



| A    | B                                                                                                                                        | C                             | D      | E                                       | F | G | H | I                                                   | J      | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|--------|-----------------------------------------|---|---|---|-----------------------------------------------------|--------|---|---|
| 1810 |                                                                                                                                          |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1811 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1812 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1813 |                                                                                                                                          |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1814 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1815 |                                                                                                                                          | 95% CLT UCL                   | 0.0377 |                                         |   |   |   | 95% Jackknife UCL                                   | 0.039  |   |   |
| 1816 |                                                                                                                                          | 95% Standard Bootstrap UCL    | 0.037  |                                         |   |   |   | 95% Bootstrap-t UCL                                 | 0.0478 |   |   |
| 1817 |                                                                                                                                          | 95% Hall's Bootstrap UCL      | 0.0449 |                                         |   |   |   | 95% Percentile Bootstrap UCL                        | 0.0378 |   |   |
| 1818 |                                                                                                                                          | 95% BCA Bootstrap UCL         | 0.0414 |                                         |   |   |   |                                                     |        |   |   |
| 1819 |                                                                                                                                          | 90% Chebyshev(Mean, Sd) UCL   | 0.0456 |                                         |   |   |   | 95% Chebyshev(Mean, Sd) UCL                         | 0.0534 |   |   |
| 1820 |                                                                                                                                          | 97.5% Chebyshev(Mean, Sd) UCL | 0.0643 |                                         |   |   |   | 99% Chebyshev(Mean, Sd) UCL                         | 0.0858 |   |   |
| 1821 |                                                                                                                                          |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1822 | <b>Suggested UCL to Use</b>                                                                                                              |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1823 |                                                                                                                                          | 95% Student's-t UCL           | 0.039  |                                         |   |   |   |                                                     |        |   |   |
| 1824 |                                                                                                                                          |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1825 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                           |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1826 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                   |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1827 |                                                                                                                                          |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1828 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1829 | Recommendations are based upon data size, data distribution, and skewness.                                                               |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1830 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1831 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1832 |                                                                                                                                          |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1833 |                                                                                                                                          |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1834 | <b>Result (grouseorgan_iron)</b>                                                                                                         |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1835 |                                                                                                                                          |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1836 | <b>General Statistics</b>                                                                                                                |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1837 | Total Number of Observations                                                                                                             | 9                             |        |                                         |   |   |   | Number of Distinct Observations                     | 9      |   |   |
| 1838 |                                                                                                                                          |                               |        |                                         |   |   |   | Number of Missing Observations                      | 0      |   |   |
| 1839 | Minimum                                                                                                                                  | 45.65                         |        |                                         |   |   |   | Mean                                                | 148.9  |   |   |
| 1840 | Maximum                                                                                                                                  | 376.5                         |        |                                         |   |   |   | Median                                              | 58.21  |   |   |
| 1841 | SD                                                                                                                                       | 137.9                         |        |                                         |   |   |   | Std. Error of Mean                                  | 45.97  |   |   |
| 1842 | Coefficient of Variation                                                                                                                 | 0.926                         |        |                                         |   |   |   | Skewness                                            | 0.917  |   |   |
| 1843 |                                                                                                                                          |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1844 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1845 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1846 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1847 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1848 |                                                                                                                                          |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1849 | <b>Normal GOF Test</b>                                                                                                                   |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1850 | Shapiro Wilk Test Statistic                                                                                                              | 0.731                         |        |                                         |   |   |   | <b>Shapiro Wilk GOF Test</b>                        |        |   |   |
| 1851 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.829                         |        |                                         |   |   |   | Data Not Normal at 5% Significance Level            |        |   |   |
| 1852 | Lilliefors Test Statistic                                                                                                                | 0.335                         |        |                                         |   |   |   | <b>Lilliefors GOF Test</b>                          |        |   |   |
| 1853 | 5% Lilliefors Critical Value                                                                                                             | 0.274                         |        |                                         |   |   |   | Data Not Normal at 5% Significance Level            |        |   |   |
| 1854 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1855 |                                                                                                                                          |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1856 | <b>Assuming Normal Distribution</b>                                                                                                      |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1857 | <b>95% Normal UCL</b>                                                                                                                    |                               |        | <b>95% UCLs (Adjusted for Skewness)</b> |   |   |   |                                                     |        |   |   |
| 1858 | 95% Student's-t UCL                                                                                                                      | 234.4                         |        |                                         |   |   |   | 95% Adjusted-CLT UCL (Chen-1995)                    | 239.5  |   |   |
| 1859 |                                                                                                                                          |                               |        |                                         |   |   |   | 95% Modified-t UCL (Johnson-1978)                   | 236.7  |   |   |
| 1860 |                                                                                                                                          |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1861 | <b>Gamma GOF Test</b>                                                                                                                    |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1862 | A-D Test Statistic                                                                                                                       | 1.103                         |        |                                         |   |   |   | <b>Anderson-Darling Gamma GOF Test</b>              |        |   |   |
| 1863 | 5% A-D Critical Value                                                                                                                    | 0.735                         |        |                                         |   |   |   | Data Not Gamma Distributed at 5% Significance Level |        |   |   |
| 1864 | K-S Test Statistic                                                                                                                       | 0.311                         |        |                                         |   |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |        |   |   |
| 1865 | 5% K-S Critical Value                                                                                                                    | 0.284                         |        |                                         |   |   |   | Data Not Gamma Distributed at 5% Significance Level |        |   |   |
| 1866 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1867 |                                                                                                                                          |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1868 | <b>Gamma Statistics</b>                                                                                                                  |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1869 | k hat (MLE)                                                                                                                              | 1.467                         |        |                                         |   |   |   | k star (bias corrected MLE)                         | 1.052  |   |   |
| 1870 | Theta hat (MLE)                                                                                                                          | 101.5                         |        |                                         |   |   |   | Theta star (bias corrected MLE)                     | 141.5  |   |   |
| 1871 | nu hat (MLE)                                                                                                                             | 26.4                          |        |                                         |   |   |   | nu star (bias corrected)                            | 18.94  |   |   |
| 1872 | MLE Mean (bias corrected)                                                                                                                | 148.9                         |        |                                         |   |   |   | MLE Sd (bias corrected)                             | 145.2  |   |   |
| 1873 |                                                                                                                                          |                               |        |                                         |   |   |   | Approximate Chi Square Value (0.05)                 | 10.07  |   |   |
| 1874 | Adjusted Level of Significance                                                                                                           | 0.0231                        |        |                                         |   |   |   | Adjusted Chi Square Value                           | 8.74   |   |   |
| 1875 |                                                                                                                                          |                               |        |                                         |   |   |   |                                                     |        |   |   |
| 1876 | <b>Assuming Gamma Distribution</b>                                                                                                       |                               |        |                                         |   |   |   |                                                     |        |   |   |

| A    | B                                                                                                                                        | C | D | E     | F                                                               | G | H | I     | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|-------|-----------------------------------------------------------------|---|---|-------|---|---|---|
| 1877 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |   | 280   | 95% Adjusted Gamma UCL (use when n<50)                          |   |   | 322.6 |   |   |   |
| 1878 |                                                                                                                                          |   |   |       |                                                                 |   |   |       |   |   |   |
| 1879 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |       |                                                                 |   |   |       |   |   |   |
| 1880 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.779 | Shapiro Wilk Lognormal GOF Test                                 |   |   |       |   |   |   |
| 1881 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.829 | Data Not Lognormal at 5% Significance Level                     |   |   |       |   |   |   |
| 1882 | Lilliefors Test Statistic                                                                                                                |   |   | 0.289 | Lilliefors Lognormal GOF Test                                   |   |   |       |   |   |   |
| 1883 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.274 | Data Not Lognormal at 5% Significance Level                     |   |   |       |   |   |   |
| 1884 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |   |   |       |                                                                 |   |   |       |   |   |   |
| 1885 |                                                                                                                                          |   |   |       |                                                                 |   |   |       |   |   |   |
| 1886 | <b>Lognormal Statistics</b>                                                                                                              |   |   |       |                                                                 |   |   |       |   |   |   |
| 1887 | Minimum of Logged Data                                                                                                                   |   |   | 3.821 | Mean of logged Data                                             |   |   | 4.625 |   |   |   |
| 1888 | Maximum of Logged Data                                                                                                                   |   |   | 5.931 | SD of logged Data                                               |   |   | 0.899 |   |   |   |
| 1889 |                                                                                                                                          |   |   |       |                                                                 |   |   |       |   |   |   |
| 1890 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |       |                                                                 |   |   |       |   |   |   |
| 1891 | 95% H-UCL                                                                                                                                |   |   | 399   | 90% Chebyshev (MVUE) UCL                                        |   |   | 278.4 |   |   |   |
| 1892 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 339.2 | 97.5% Chebyshev (MVUE) UCL                                      |   |   | 423.5 |   |   |   |
| 1893 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 589   |                                                                 |   |   |       |   |   |   |
| 1894 |                                                                                                                                          |   |   |       |                                                                 |   |   |       |   |   |   |
| 1895 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |       |                                                                 |   |   |       |   |   |   |
| 1896 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |   |   |       |                                                                 |   |   |       |   |   |   |
| 1897 |                                                                                                                                          |   |   |       |                                                                 |   |   |       |   |   |   |
| 1898 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |       |                                                                 |   |   |       |   |   |   |
| 1899 | 95% CLT UCL                                                                                                                              |   |   | 224.5 | 95% Jackknife UCL                                               |   |   | 234.4 |   |   |   |
| 1900 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 219.4 | 95% Bootstrap-t UCL                                             |   |   | 259   |   |   |   |
| 1901 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 196.3 | 95% Percentile Bootstrap UCL                                    |   |   | 223.7 |   |   |   |
| 1902 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 229   |                                                                 |   |   |       |   |   |   |
| 1903 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 286.8 | 95% Chebyshev(Mean, Sd) UCL                                     |   |   | 349.3 |   |   |   |
| 1904 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 435.9 | 99% Chebyshev(Mean, Sd) UCL                                     |   |   | 606.2 |   |   |   |
| 1905 |                                                                                                                                          |   |   |       |                                                                 |   |   |       |   |   |   |
| 1906 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |       |                                                                 |   |   |       |   |   |   |
| 1907 | 95% Chebyshev (Mean, Sd) UCL                                                                                                             |   |   | 349.3 |                                                                 |   |   |       |   |   |   |
| 1908 |                                                                                                                                          |   |   |       |                                                                 |   |   |       |   |   |   |
| 1909 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |       |                                                                 |   |   |       |   |   |   |
| 1910 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |       |                                                                 |   |   |       |   |   |   |
| 1911 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |       |                                                                 |   |   |       |   |   |   |
| 1912 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |       |                                                                 |   |   |       |   |   |   |
| 1913 |                                                                                                                                          |   |   |       |                                                                 |   |   |       |   |   |   |
| 1914 | <b>Result (grouseorgan_manganese)</b>                                                                                                    |   |   |       |                                                                 |   |   |       |   |   |   |
| 1915 |                                                                                                                                          |   |   |       |                                                                 |   |   |       |   |   |   |
| 1916 | <b>General Statistics</b>                                                                                                                |   |   |       |                                                                 |   |   |       |   |   |   |
| 1917 | Total Number of Observations                                                                                                             |   |   | 9     | Number of Distinct Observations                                 |   |   | 9     |   |   |   |
| 1918 |                                                                                                                                          |   |   |       | Number of Missing Observations                                  |   |   | 0     |   |   |   |
| 1919 | Minimum                                                                                                                                  |   |   | 0.439 | Mean                                                            |   |   | 3.75  |   |   |   |
| 1920 | Maximum                                                                                                                                  |   |   | 11.97 | Median                                                          |   |   | 3.119 |   |   |   |
| 1921 | SD                                                                                                                                       |   |   | 3.838 | Std. Error of Mean                                              |   |   | 1.279 |   |   |   |
| 1922 | Coefficient of Variation                                                                                                                 |   |   | 1.024 | Skewness                                                        |   |   | 1.475 |   |   |   |
| 1923 |                                                                                                                                          |   |   |       |                                                                 |   |   |       |   |   |   |
| 1924 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |   |   |       |                                                                 |   |   |       |   |   |   |
| 1925 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |   |   |       |                                                                 |   |   |       |   |   |   |
| 1926 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |   |   |       |                                                                 |   |   |       |   |   |   |
| 1927 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |   |   |       |                                                                 |   |   |       |   |   |   |
| 1928 |                                                                                                                                          |   |   |       |                                                                 |   |   |       |   |   |   |
| 1929 | <b>Normal GOF Test</b>                                                                                                                   |   |   |       |                                                                 |   |   |       |   |   |   |
| 1930 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.829 | Shapiro Wilk GOF Test                                           |   |   |       |   |   |   |
| 1931 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.829 | Data appear Normal at 5% Significance Level                     |   |   |       |   |   |   |
| 1932 | Lilliefors Test Statistic                                                                                                                |   |   | 0.271 | Lilliefors GOF Test                                             |   |   |       |   |   |   |
| 1933 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.274 | Data appear Normal at 5% Significance Level                     |   |   |       |   |   |   |
| 1934 | <b>Data appear Normal at 5% Significance Level</b>                                                                                       |   |   |       |                                                                 |   |   |       |   |   |   |
| 1935 |                                                                                                                                          |   |   |       |                                                                 |   |   |       |   |   |   |
| 1936 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |       |                                                                 |   |   |       |   |   |   |
| 1937 | <b>95% Normal UCL</b>                                                                                                                    |   |   |       | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |       |   |   |   |
| 1938 | 95% Student's-t UCL                                                                                                                      |   |   | 6.129 | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   | 6.527 |   |   |   |
| 1939 |                                                                                                                                          |   |   |       | 95% Modified-t UCL (Johnson-1978)                               |   |   | 6.234 |   |   |   |
| 1940 |                                                                                                                                          |   |   |       |                                                                 |   |   |       |   |   |   |
| 1941 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |       |                                                                 |   |   |       |   |   |   |
| 1942 | A-D Test Statistic                                                                                                                       |   |   | 0.26  | Anderson-Darling Gamma GOF Test                                 |   |   |       |   |   |   |
| 1943 | 5% A-D Critical Value                                                                                                                    |   |   | 0.742 | detected data appear Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |

| A    | B                                                                                                                                                | C | D | E      | F                                                               | G | H | I     | J | K | L |  |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------------------|---|---|-------|---|---|---|--|
| 1944 | K-S Test Statistic                                                                                                                               |   |   | 0.146  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |       |   |   |   |  |
| 1945 | 5% K-S Critical Value                                                                                                                            |   |   | 0.286  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |  |
| 1946 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1947 |                                                                                                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1948 | <b>Gamma Statistics</b>                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1949 | k hat (MLE)                                                                                                                                      |   |   | 1.094  | k star (bias corrected MLE)                                     |   |   | 0.803 |   |   |   |  |
| 1950 | Theta hat (MLE)                                                                                                                                  |   |   | 3.429  | Theta star (bias corrected MLE)                                 |   |   | 4.669 |   |   |   |  |
| 1951 | nu hat (MLE)                                                                                                                                     |   |   | 19.68  | nu star (bias corrected)                                        |   |   | 14.46 |   |   |   |  |
| 1952 | MLE Mean (bias corrected)                                                                                                                        |   |   | 3.75   | MLE Sd (bias corrected)                                         |   |   | 4.184 |   |   |   |  |
| 1953 |                                                                                                                                                  |   |   |        | Approximate Chi Square Value (0.05)                             |   |   | 6.885 |   |   |   |  |
| 1954 | Adjusted Level of Significance                                                                                                                   |   |   | 0.0231 | Adjusted Chi Square Value                                       |   |   | 5.819 |   |   |   |  |
| 1955 |                                                                                                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1956 | <b>Assuming Gamma Distribution</b>                                                                                                               |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1957 | 95% Approximate Gamma UCL (use when n>=50))                                                                                                      |   |   | 7.874  | 95% Adjusted Gamma UCL (use when n<50)                          |   |   | 9.316 |   |   |   |  |
| 1958 |                                                                                                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1959 | <b>Lognormal GOF Test</b>                                                                                                                        |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1960 | Shapiro Wilk Test Statistic                                                                                                                      |   |   | 0.945  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |       |   |   |   |  |
| 1961 | 5% Shapiro Wilk Critical Value                                                                                                                   |   |   | 0.829  | Data appear Lognormal at 5% Significance Level                  |   |   |       |   |   |   |  |
| 1962 | Lilliefors Test Statistic                                                                                                                        |   |   | 0.17   | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |       |   |   |   |  |
| 1963 | 5% Lilliefors Critical Value                                                                                                                     |   |   | 0.274  | Data appear Lognormal at 5% Significance Level                  |   |   |       |   |   |   |  |
| 1964 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                            |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1965 |                                                                                                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1966 | <b>Lognormal Statistics</b>                                                                                                                      |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1967 | Minimum of Logged Data                                                                                                                           |   |   | -0.823 | Mean of logged Data                                             |   |   | 0.799 |   |   |   |  |
| 1968 | Maximum of Logged Data                                                                                                                           |   |   | 2.483  | SD of logged Data                                               |   |   | 1.159 |   |   |   |  |
| 1969 |                                                                                                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1970 | <b>Assuming Lognormal Distribution</b>                                                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1971 | 95% H-UCL                                                                                                                                        |   |   | 19.06  | 90% Chebyshev (MVUE) UCL                                        |   |   | 8.627 |   |   |   |  |
| 1972 | 95% Chebyshev (MVUE) UCL                                                                                                                         |   |   | 10.76  | 97.5% Chebyshev (MVUE) UCL                                      |   |   | 13.72 |   |   |   |  |
| 1973 | 99% Chebyshev (MVUE) UCL                                                                                                                         |   |   | 19.54  |                                                                 |   |   |       |   |   |   |  |
| 1974 |                                                                                                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1975 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                            |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1976 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                                 |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1977 |                                                                                                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1978 | <b>Nonparametric Distribution Free UCLs</b>                                                                                                      |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1979 | 95% CLT UCL                                                                                                                                      |   |   | 5.855  | 95% Jackknife UCL                                               |   |   | 6.129 |   |   |   |  |
| 1980 | 95% Standard Bootstrap UCL                                                                                                                       |   |   | 5.723  | 95% Bootstrap-t UCL                                             |   |   | 8.627 |   |   |   |  |
| 1981 | 95% Hall's Bootstrap UCL                                                                                                                         |   |   | 18.5   | 95% Percentile Bootstrap UCL                                    |   |   | 5.895 |   |   |   |  |
| 1982 | 95% BCA Bootstrap UCL                                                                                                                            |   |   | 6.41   |                                                                 |   |   |       |   |   |   |  |
| 1983 | 90% Chebyshev(Mean, Sd) UCL                                                                                                                      |   |   | 7.588  | 95% Chebyshev(Mean, Sd) UCL                                     |   |   | 9.327 |   |   |   |  |
| 1984 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                                    |   |   | 11.74  | 99% Chebyshev(Mean, Sd) UCL                                     |   |   | 16.48 |   |   |   |  |
| 1985 |                                                                                                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1986 | <b>Suggested UCL to Use</b>                                                                                                                      |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1987 | 95% Student's-t UCL                                                                                                                              |   |   | 6.129  |                                                                 |   |   |       |   |   |   |  |
| 1988 |                                                                                                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1989 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.                     |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1990 | Recommendations are based upon data size, data distribution, and skewness.                                                                       |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1991 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                         |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1992 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician         |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1993 |                                                                                                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1994 | <b>Result (grouseorgan_mercury)</b>                                                                                                              |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1995 |                                                                                                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1996 | <b>General Statistics</b>                                                                                                                        |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1997 | Total Number of Observations                                                                                                                     |   |   | 9      | Number of Distinct Observations                                 |   |   | 9     |   |   |   |  |
| 1998 | Number of Detects                                                                                                                                |   |   | 1      | Number of Non-Detects                                           |   |   | 8     |   |   |   |  |
| 1999 | Number of Distinct Detects                                                                                                                       |   |   | 1      | Number of Distinct Non-Detects                                  |   |   | 8     |   |   |   |  |
| 2000 |                                                                                                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 2001 | <b>Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!</b>                 |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 2002 | <b>It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, B</b> |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 2003 |                                                                                                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 2004 | <b>The data set for variable Result (grouseorgan_mercury) was not processed!</b>                                                                 |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 2005 |                                                                                                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 2006 |                                                                                                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 2007 | <b>Result (grouseorgan_thallium)</b>                                                                                                             |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 2008 |                                                                                                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 2009 | <b>General Statistics</b>                                                                                                                        |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 2010 | Total Number of Observations                                                                                                                     |   |   | 9      | Number of Distinct Observations                                 |   |   | 9     |   |   |   |  |

| A    | B                                                                                                                                 | C | E | F | G      | H                                                               | I | J | K | L     |
|------|-----------------------------------------------------------------------------------------------------------------------------------|---|---|---|--------|-----------------------------------------------------------------|---|---|---|-------|
| 2011 | Number of Detects                                                                                                                 |   |   |   | 0      | Number of Non-Detects                                           |   |   |   | 9     |
| 2012 | Number of Distinct Detects                                                                                                        |   |   |   | 0      | Number of Distinct Non-Detects                                  |   |   |   | 9     |
| 2013 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |       |
| 2014 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                |   |   |   |        |                                                                 |   |   |   |       |
| 2015 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>          |   |   |   |        |                                                                 |   |   |   |       |
| 2016 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b> |   |   |   |        |                                                                 |   |   |   |       |
| 2017 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |       |
| 2018 | <b>The data set for variable Result (grouseorgan_thallium) was not processed!</b>                                                 |   |   |   |        |                                                                 |   |   |   |       |
| 2019 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |       |
| 2020 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |       |
| 2021 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |       |
| 2022 | <b>Result (grouseorgan_zinc)</b>                                                                                                  |   |   |   |        |                                                                 |   |   |   |       |
| 2023 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |       |
| 2024 | <b>General Statistics</b>                                                                                                         |   |   |   |        |                                                                 |   |   |   |       |
| 2025 | Total Number of Observations                                                                                                      |   |   |   | 9      | Number of Distinct Observations                                 |   |   |   | 9     |
| 2026 |                                                                                                                                   |   |   |   |        | Number of Missing Observations                                  |   |   |   | 0     |
| 2027 | Minimum                                                                                                                           |   |   |   | 22.85  | Mean                                                            |   |   |   | 26.68 |
| 2028 | Maximum                                                                                                                           |   |   |   | 33.41  | Median                                                          |   |   |   | 25.57 |
| 2029 | SD                                                                                                                                |   |   |   | 3.943  | Std. Error of Mean                                              |   |   |   | 1.314 |
| 2030 | Coefficient of Variation                                                                                                          |   |   |   | 0.148  | Skewness                                                        |   |   |   | 0.709 |
| 2031 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |       |
| 2032 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                        |   |   |   |        |                                                                 |   |   |   |       |
| 2033 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                            |   |   |   |        |                                                                 |   |   |   |       |
| 2034 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                               |   |   |   |        |                                                                 |   |   |   |       |
| 2035 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                    |   |   |   |        |                                                                 |   |   |   |       |
| 2036 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |       |
| 2037 | <b>Normal GOF Test</b>                                                                                                            |   |   |   |        |                                                                 |   |   |   |       |
| 2038 | Shapiro Wilk Test Statistic                                                                                                       |   |   |   | 0.868  | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |       |
| 2039 | 5% Shapiro Wilk Critical Value                                                                                                    |   |   |   | 0.829  | Data appear Normal at 5% Significance Level                     |   |   |   |       |
| 2040 | Lilliefors Test Statistic                                                                                                         |   |   |   | 0.233  | <b>Lilliefors GOF Test</b>                                      |   |   |   |       |
| 2041 | 5% Lilliefors Critical Value                                                                                                      |   |   |   | 0.274  | Data appear Normal at 5% Significance Level                     |   |   |   |       |
| 2042 | <b>Data appear Normal at 5% Significance Level</b>                                                                                |   |   |   |        |                                                                 |   |   |   |       |
| 2043 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |       |
| 2044 | <b>Assuming Normal Distribution</b>                                                                                               |   |   |   |        |                                                                 |   |   |   |       |
| 2045 | <b>95% Normal UCL</b>                                                                                                             |   |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |   |       |
| 2046 | 95% Student's-t UCL                                                                                                               |   |   |   | 29.13  | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |   | 29.17 |
| 2047 |                                                                                                                                   |   |   |   |        | 95% Modified-t UCL (Johnson-1978)                               |   |   |   | 29.18 |
| 2048 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |       |
| 2049 | <b>Gamma GOF Test</b>                                                                                                             |   |   |   |        |                                                                 |   |   |   |       |
| 2050 | A-D Test Statistic                                                                                                                |   |   |   | 0.566  | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |   |       |
| 2051 | 5% A-D Critical Value                                                                                                             |   |   |   | 0.72   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |       |
| 2052 | K-S Test Statistic                                                                                                                |   |   |   | 0.25   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |   |       |
| 2053 | 5% K-S Critical Value                                                                                                             |   |   |   | 0.279  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |       |
| 2054 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                            |   |   |   |        |                                                                 |   |   |   |       |
| 2055 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |       |
| 2056 | <b>Gamma Statistics</b>                                                                                                           |   |   |   |        |                                                                 |   |   |   |       |
| 2057 | k hat (MLE)                                                                                                                       |   |   |   | 53.74  | k star (bias corrected MLE)                                     |   |   |   | 35.9  |
| 2058 | Theta hat (MLE)                                                                                                                   |   |   |   | 0.497  | Theta star (bias corrected MLE)                                 |   |   |   | 0.743 |
| 2059 | nu hat (MLE)                                                                                                                      |   |   |   | 967.2  | nu star (bias corrected)                                        |   |   |   | 646.2 |
| 2060 | MLE Mean (bias corrected)                                                                                                         |   |   |   | 26.68  | MLE Sd (bias corrected)                                         |   |   |   | 4.453 |
| 2061 |                                                                                                                                   |   |   |   |        | Approximate Chi Square Value (0.05)                             |   |   |   | 588.2 |
| 2062 | Adjusted Level of Significance                                                                                                    |   |   |   | 0.0231 | Adjusted Chi Square Value                                       |   |   |   | 576.5 |
| 2063 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |       |
| 2064 | <b>Assuming Gamma Distribution</b>                                                                                                |   |   |   |        |                                                                 |   |   |   |       |
| 2065 | 95% Approximate Gamma UCL (use when n>=50))                                                                                       |   |   |   | 29.31  | 95% Adjusted Gamma UCL (use when n<50)                          |   |   |   | 29.91 |
| 2066 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |       |
| 2067 | <b>Lognormal GOF Test</b>                                                                                                         |   |   |   |        |                                                                 |   |   |   |       |
| 2068 | Shapiro Wilk Test Statistic                                                                                                       |   |   |   | 0.875  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |   |       |
| 2069 | 5% Shapiro Wilk Critical Value                                                                                                    |   |   |   | 0.829  | Data appear Lognormal at 5% Significance Level                  |   |   |   |       |
| 2070 | Lilliefors Test Statistic                                                                                                         |   |   |   | 0.237  | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |   |       |
| 2071 | 5% Lilliefors Critical Value                                                                                                      |   |   |   | 0.274  | Data appear Lognormal at 5% Significance Level                  |   |   |   |       |
| 2072 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                             |   |   |   |        |                                                                 |   |   |   |       |
| 2073 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |       |
| 2074 | <b>Lognormal Statistics</b>                                                                                                       |   |   |   |        |                                                                 |   |   |   |       |
| 2075 | Minimum of Logged Data                                                                                                            |   |   |   | 3.129  | Mean of logged Data                                             |   |   |   | 3.275 |
| 2076 | Maximum of Logged Data                                                                                                            |   |   |   | 3.509  | SD of logged Data                                               |   |   |   | 0.143 |
| 2077 |                                                                                                                                   |   |   |   |        |                                                                 |   |   |   |       |

|      | A                                                                                                                                       | B | C | D | E                             | F     | G | H | I | J | K                            | L     |
|------|-----------------------------------------------------------------------------------------------------------------------------------------|---|---|---|-------------------------------|-------|---|---|---|---|------------------------------|-------|
| 2078 | <b>Assuming Lognormal Distribution</b>                                                                                                  |   |   |   |                               |       |   |   |   |   |                              |       |
| 2079 |                                                                                                                                         |   |   |   | 95% H-UCL                     | 29.35 |   |   |   |   | 90% Chebyshev (MVUE) UCL     | 30.51 |
| 2080 |                                                                                                                                         |   |   |   | 95% Chebyshev (MVUE) UCL      | 32.25 |   |   |   |   | 97.5% Chebyshev (MVUE) UCL   | 34.65 |
| 2081 |                                                                                                                                         |   |   |   | 99% Chebyshev (MVUE) UCL      | 39.39 |   |   |   |   |                              |       |
| 2082 |                                                                                                                                         |   |   |   |                               |       |   |   |   |   |                              |       |
| 2083 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                   |   |   |   |                               |       |   |   |   |   |                              |       |
| 2084 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                        |   |   |   |                               |       |   |   |   |   |                              |       |
| 2085 |                                                                                                                                         |   |   |   |                               |       |   |   |   |   |                              |       |
| 2086 | <b>Nonparametric Distribution Free UCLs</b>                                                                                             |   |   |   |                               |       |   |   |   |   |                              |       |
| 2087 |                                                                                                                                         |   |   |   | 95% CLT UCL                   | 28.84 |   |   |   |   | 95% Jackknife UCL            | 29.13 |
| 2088 |                                                                                                                                         |   |   |   | 95% Standard Bootstrap UCL    | 28.74 |   |   |   |   | 95% Bootstrap-t UCL          | 29.69 |
| 2089 |                                                                                                                                         |   |   |   | 95% Hall's Bootstrap UCL      | 28.7  |   |   |   |   | 95% Percentile Bootstrap UCL | 28.86 |
| 2090 |                                                                                                                                         |   |   |   | 95% BCA Bootstrap UCL         | 29.1  |   |   |   |   |                              |       |
| 2091 |                                                                                                                                         |   |   |   | 90% Chebyshev(Mean, Sd) UCL   | 30.62 |   |   |   |   | 95% Chebyshev(Mean, Sd) UCL  | 32.41 |
| 2092 |                                                                                                                                         |   |   |   | 97.5% Chebyshev(Mean, Sd) UCL | 34.89 |   |   |   |   | 99% Chebyshev(Mean, Sd) UCL  | 39.76 |
| 2093 |                                                                                                                                         |   |   |   |                               |       |   |   |   |   |                              |       |
| 2094 | <b>Suggested UCL to Use</b>                                                                                                             |   |   |   |                               |       |   |   |   |   |                              |       |
| 2095 |                                                                                                                                         |   |   |   | 95% Student's-t UCL           | 29.13 |   |   |   |   |                              |       |
| 2096 |                                                                                                                                         |   |   |   |                               |       |   |   |   |   |                              |       |
| 2097 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.            |   |   |   |                               |       |   |   |   |   |                              |       |
| 2098 | Recommendations are based upon data size, data distribution, and skewness.                                                              |   |   |   |                               |       |   |   |   |   |                              |       |
| 2099 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                |   |   |   |                               |       |   |   |   |   |                              |       |
| 2100 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statisticia |   |   |   |                               |       |   |   |   |   |                              |       |
| 2101 |                                                                                                                                         |   |   |   |                               |       |   |   |   |   |                              |       |

|    | A                                                                                                                         | B                                      | C                                                               | D      | E | F | G | H | I | J | K | L |
|----|---------------------------------------------------------------------------------------------------------------------------|----------------------------------------|-----------------------------------------------------------------|--------|---|---|---|---|---|---|---|---|
| 1  | <b>UCL Statistics for Data Sets with Non-Detects</b>                                                                      |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 2  |                                                                                                                           |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 3  | User Selected Options                                                                                                     |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 4  | Date/Time of Computation                                                                                                  | ProUCL 5.12/11/2019 10:35:43 AM        |                                                                 |        |   |   |   |   |   |   |   |   |
| 5  | From File                                                                                                                 | BPMD_HHRA_HikerHunter_SoilInput_v3.xls |                                                                 |        |   |   |   |   |   |   |   |   |
| 6  | Full Precision                                                                                                            | OFF                                    |                                                                 |        |   |   |   |   |   |   |   |   |
| 7  | Confidence Coefficient                                                                                                    | 95%                                    |                                                                 |        |   |   |   |   |   |   |   |   |
| 8  | Number of Bootstrap Operations                                                                                            | 2000                                   |                                                                 |        |   |   |   |   |   |   |   |   |
| 9  |                                                                                                                           |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 10 | <b>Result (eu1_antimony_overbank)</b>                                                                                     |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 11 |                                                                                                                           |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 12 | <b>General Statistics</b>                                                                                                 |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 13 | Total Number of Observations                                                                                              | 29                                     | Number of Distinct Observations                                 | 27     |   |   |   |   |   |   |   |   |
| 14 | Number of Detects                                                                                                         | 18                                     | Number of Non-Detects                                           | 11     |   |   |   |   |   |   |   |   |
| 15 | Number of Distinct Detects                                                                                                | 16                                     | Number of Distinct Non-Detects                                  | 11     |   |   |   |   |   |   |   |   |
| 16 | Minimum Detect                                                                                                            | 0.67                                   | Minimum Non-Detect                                              | 0.032  |   |   |   |   |   |   |   |   |
| 17 | Maximum Detect                                                                                                            | 12                                     | Maximum Non-Detect                                              | 0.071  |   |   |   |   |   |   |   |   |
| 18 | Variance Detects                                                                                                          | 8.251                                  | Percent Non-Detects                                             | 37.93% |   |   |   |   |   |   |   |   |
| 19 | Mean Detects                                                                                                              | 4.737                                  | SD Detects                                                      | 2.872  |   |   |   |   |   |   |   |   |
| 20 | Median Detects                                                                                                            | 4.15                                   | CV Detects                                                      | 0.606  |   |   |   |   |   |   |   |   |
| 21 | Skewness Detects                                                                                                          | 1.032                                  | Kurtosis Detects                                                | 1.238  |   |   |   |   |   |   |   |   |
| 22 | Mean of Logged Detects                                                                                                    | 1.358                                  | SD of Logged Detects                                            | 0.699  |   |   |   |   |   |   |   |   |
| 23 |                                                                                                                           |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 24 | <b>Normal GOF Test on Detects Only</b>                                                                                    |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 25 | Shapiro Wilk Test Statistic                                                                                               | 0.93                                   | <b>Shapiro Wilk GOF Test</b>                                    |        |   |   |   |   |   |   |   |   |
| 26 | 5% Shapiro Wilk Critical Value                                                                                            | 0.897                                  | Detected Data appear Normal at 5% Significance Level            |        |   |   |   |   |   |   |   |   |
| 27 | Lilliefors Test Statistic                                                                                                 | 0.151                                  | <b>Lilliefors GOF Test</b>                                      |        |   |   |   |   |   |   |   |   |
| 28 | 5% Lilliefors Critical Value                                                                                              | 0.202                                  | Detected Data appear Normal at 5% Significance Level            |        |   |   |   |   |   |   |   |   |
| 29 | <b>Detected Data appear Normal at 5% Significance Level</b>                                                               |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 30 |                                                                                                                           |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 31 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 32 | KM Mean                                                                                                                   | 2.952                                  | KM Standard Error of Mean                                       | 0.606  |   |   |   |   |   |   |   |   |
| 33 | KM SD                                                                                                                     | 3.17                                   | 95% KM (BCA) UCL                                                | 3.927  |   |   |   |   |   |   |   |   |
| 34 | 95% KM (t) UCL                                                                                                            | 3.983                                  | 95% KM (Percentile Bootstrap) UCL                               | 3.97   |   |   |   |   |   |   |   |   |
| 35 | 95% KM (z) UCL                                                                                                            | 3.949                                  | 95% KM Bootstrap t UCL                                          | 4.117  |   |   |   |   |   |   |   |   |
| 36 | 90% KM Chebyshev UCL                                                                                                      | 4.77                                   | 95% KM Chebyshev UCL                                            | 5.593  |   |   |   |   |   |   |   |   |
| 37 | 97.5% KM Chebyshev UCL                                                                                                    | 6.735                                  | 99% KM Chebyshev UCL                                            | 8.979  |   |   |   |   |   |   |   |   |
| 38 |                                                                                                                           |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 39 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 40 | A-D Test Statistic                                                                                                        | 0.199                                  | <b>Anderson-Darling GOF Test</b>                                |        |   |   |   |   |   |   |   |   |
| 41 | 5% A-D Critical Value                                                                                                     | 0.748                                  | detected data appear Gamma Distributed at 5% Significance Level |        |   |   |   |   |   |   |   |   |
| 42 | K-S Test Statistic                                                                                                        | 0.108                                  | <b>Kolmogorov-Smimov GOF</b>                                    |        |   |   |   |   |   |   |   |   |
| 43 | 5% K-S Critical Value                                                                                                     | 0.205                                  | detected data appear Gamma Distributed at 5% Significance Level |        |   |   |   |   |   |   |   |   |
| 44 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                    |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 45 |                                                                                                                           |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 46 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 47 | k hat (MLE)                                                                                                               | 2.692                                  | k star (bias corrected MLE)                                     | 2.28   |   |   |   |   |   |   |   |   |
| 48 | Theta hat (MLE)                                                                                                           | 1.76                                   | Theta star (bias corrected MLE)                                 | 2.077  |   |   |   |   |   |   |   |   |
| 49 | nu hat (MLE)                                                                                                              | 96.91                                  | nu star (bias corrected)                                        | 82.09  |   |   |   |   |   |   |   |   |
| 50 | Mean (detects)                                                                                                            | 4.737                                  |                                                                 |        |   |   |   |   |   |   |   |   |
| 51 |                                                                                                                           |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 52 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 53 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 54 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 55 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 56 | This is especially true when the sample size is small.                                                                    |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 57 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |                                        |                                                                 |        |   |   |   |   |   |   |   |   |
| 58 | Minimum                                                                                                                   | 0.01                                   | Mean                                                            | 2.944  |   |   |   |   |   |   |   |   |
| 59 | Maximum                                                                                                                   | 12                                     | Median                                                          | 1.9    |   |   |   |   |   |   |   |   |
| 60 | SD                                                                                                                        | 3.234                                  | CV                                                              | 1.098  |   |   |   |   |   |   |   |   |
| 61 | k hat (MLE)                                                                                                               | 0.341                                  | k star (bias corrected MLE)                                     | 0.328  |   |   |   |   |   |   |   |   |
| 62 | Theta hat (MLE)                                                                                                           | 8.646                                  | Theta star (bias corrected MLE)                                 | 8.968  |   |   |   |   |   |   |   |   |
| 63 | nu hat (MLE)                                                                                                              | 19.75                                  | nu star (bias corrected)                                        | 19.04  |   |   |   |   |   |   |   |   |
| 64 | Adjusted Level of Significance ( $\beta$ )                                                                                | 0.0407                                 |                                                                 |        |   |   |   |   |   |   |   |   |
| 65 | Approximate Chi Square Value (19.04, $\alpha$ )                                                                           | 10.15                                  | Adjusted Chi Square Value (19.04, $\beta$ )                     | 9.76   |   |   |   |   |   |   |   |   |
| 66 | 95% Gamma Approximate UCL (use when n>=50)                                                                                | 5.525                                  | 95% Gamma Adjusted UCL (use when n<50)                          | 5.744  |   |   |   |   |   |   |   |   |
| 67 |                                                                                                                           |                                        |                                                                 |        |   |   |   |   |   |   |   |   |

|     | A                                                                                                                                        | B | C | D      | E                                                       | F | G                           | H     | I | J | K | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|---------------------------------------------------------|---|-----------------------------|-------|---|---|---|---|
| 68  | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 69  | Mean (KM)                                                                                                                                |   |   | 2.952  | SD (KM)                                                 |   |                             | 3.17  |   |   |   |   |
| 70  | Variance (KM)                                                                                                                            |   |   | 10.05  | SE of Mean (KM)                                         |   |                             | 0.606 |   |   |   |   |
| 71  | k hat (KM)                                                                                                                               |   |   | 0.867  | k star (KM)                                             |   |                             | 0.801 |   |   |   |   |
| 72  | nu hat (KM)                                                                                                                              |   |   | 50.31  | nu star (KM)                                            |   |                             | 46.44 |   |   |   |   |
| 73  | theta hat (KM)                                                                                                                           |   |   | 3.404  | theta star (KM)                                         |   |                             | 3.687 |   |   |   |   |
| 74  | 80% gamma percentile (KM)                                                                                                                |   |   | 4.825  | 90% gamma percentile (KM)                               |   |                             | 7.178 |   |   |   |   |
| 75  | 95% gamma percentile (KM)                                                                                                                |   |   | 9.575  | 99% gamma percentile (KM)                               |   |                             | 15.23 |   |   |   |   |
| 76  |                                                                                                                                          |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 77  | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 78  | Approximate Chi Square Value (46.44, $\alpha$ )                                                                                          |   |   | 31.8   | Adjusted Chi Square Value (46.44, $\beta$ )             |   |                             | 31.08 |   |   |   |   |
| 79  | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                      |   |   | 4.311  | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )          |   |                             | 4.412 |   |   |   |   |
| 80  |                                                                                                                                          |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 81  | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 82  | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.951  | <b>Shapiro Wilk GOF Test</b>                            |   |                             |       |   |   |   |   |
| 83  | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.897  | Detected Data appear Lognormal at 5% Significance Level |   |                             |       |   |   |   |   |
| 84  | Lilliefors Test Statistic                                                                                                                |   |   | 0.151  | <b>Lilliefors GOF Test</b>                              |   |                             |       |   |   |   |   |
| 85  | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.202  | Detected Data appear Lognormal at 5% Significance Level |   |                             |       |   |   |   |   |
| 86  | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                           |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 87  |                                                                                                                                          |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 88  | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 89  | Mean in Original Scale                                                                                                                   |   |   | 3.241  | Mean in Log Scale                                       |   |                             | 0.755 |   |   |   |   |
| 90  | SD in Original Scale                                                                                                                     |   |   | 2.967  | SD in Log Scale                                         |   |                             | 0.956 |   |   |   |   |
| 91  | 95% t UCL (assumes normality of ROS data)                                                                                                |   |   | 4.178  | 95% Percentile Bootstrap UCL                            |   |                             | 4.135 |   |   |   |   |
| 92  | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 4.251  | 95% Bootstrap t UCL                                     |   |                             | 4.343 |   |   |   |   |
| 93  | 95% H-UCL (Log ROS)                                                                                                                      |   |   | 5.197  |                                                         |   |                             |       |   |   |   |   |
| 94  |                                                                                                                                          |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 95  | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 96  | KM Mean (logged)                                                                                                                         |   |   | -0.462 | KM Geo Mean                                             |   |                             | 0.63  |   |   |   |   |
| 97  | KM SD (logged)                                                                                                                           |   |   | 2.39   | 95% Critical H Value (KM-Log)                           |   |                             | 4.535 |   |   |   |   |
| 98  | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.457  | 95% H-UCL (KM -Log)                                     |   |                             | 84.91 |   |   |   |   |
| 99  | KM SD (logged)                                                                                                                           |   |   | 2.39   | 95% Critical H Value (KM-Log)                           |   |                             | 4.535 |   |   |   |   |
| 100 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.457  |                                                         |   |                             |       |   |   |   |   |
| 101 |                                                                                                                                          |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 102 | <b>DL/2 Statistics</b>                                                                                                                   |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 103 | <b>DL/2 Normal</b>                                                                                                                       |   |   |        |                                                         |   | <b>DL/2 Log-Transformed</b> |       |   |   |   |   |
| 104 | Mean in Original Scale                                                                                                                   |   |   | 2.949  | Mean in Log Scale                                       |   |                             | -0.59 |   |   |   |   |
| 105 | SD in Original Scale                                                                                                                     |   |   | 3.229  | SD in Log Scale                                         |   |                             | 2.599 |   |   |   |   |
| 106 | 95% t UCL (Assumes normality)                                                                                                            |   |   | 3.969  | 95% H-Stat UCL                                          |   |                             | 178.1 |   |   |   |   |
| 107 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 108 |                                                                                                                                          |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 109 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 110 | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                  |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 111 |                                                                                                                                          |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 112 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 113 | 95% KM (t) UCL                                                                                                                           |   |   | 3.983  |                                                         |   |                             |       |   |   |   |   |
| 114 |                                                                                                                                          |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 115 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 116 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 117 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 118 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 119 |                                                                                                                                          |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 120 |                                                                                                                                          |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 121 | <b>Result (eu1_antimony_waste rock)</b>                                                                                                  |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 122 |                                                                                                                                          |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 123 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 124 | Total Number of Observations                                                                                                             |   |   | 29     | Number of Distinct Observations                         |   |                             | 28    |   |   |   |   |
| 125 |                                                                                                                                          |   |   |        | Number of Missing Observations                          |   |                             | 0     |   |   |   |   |
| 126 | Minimum                                                                                                                                  |   |   | 0.57   | Mean                                                    |   |                             | 74.49 |   |   |   |   |
| 127 | Maximum                                                                                                                                  |   |   | 332    | Median                                                  |   |                             | 27.5  |   |   |   |   |
| 128 | SD                                                                                                                                       |   |   | 91.41  | Std. Error of Mean                                      |   |                             | 16.97 |   |   |   |   |
| 129 | Coefficient of Variation                                                                                                                 |   |   | 1.227  | Skewness                                                |   |                             | 1.615 |   |   |   |   |
| 130 |                                                                                                                                          |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 131 | <b>Normal GOF Test</b>                                                                                                                   |   |   |        |                                                         |   |                             |       |   |   |   |   |
| 132 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.758  | <b>Shapiro Wilk GOF Test</b>                            |   |                             |       |   |   |   |   |
| 133 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.926  | Data Not Normal at 5% Significance Level                |   |                             |       |   |   |   |   |
| 134 | Lilliefors Test Statistic                                                                                                                |   |   | 0.214  | <b>Lilliefors GOF Test</b>                              |   |                             |       |   |   |   |   |

| A   | B                                                                                                                                        | C | D      | E                                                               | F                                | G | H | I     | J | K | L |  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|-----------------------------------------------------------------|----------------------------------|---|---|-------|---|---|---|--|
| 135 | 5% Lilliefors Critical Value                                                                                                             |   | 0.161  | Data Not Normal at 5% Significance Level                        |                                  |   |   |       |   |   |   |  |
| 136 | Data Not Normal at 5% Significance Level                                                                                                 |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 137 |                                                                                                                                          |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 138 | Assuming Normal Distribution                                                                                                             |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 139 | 95% Normal UCL                                                                                                                           |   |        |                                                                 | 95% UCLs (Adjusted for Skewness) |   |   |       |   |   |   |  |
| 140 | 95% Student's-t UCL                                                                                                                      |   | 103.4  | 95% Adjusted-CLT UCL (Chen-1995)                                |                                  |   |   | 107.8 |   |   |   |  |
| 141 |                                                                                                                                          |   |        | 95% Modified-t UCL (Johnson-1978)                               |                                  |   |   | 104.2 |   |   |   |  |
| 142 |                                                                                                                                          |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 143 | Gamma GOF Test                                                                                                                           |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 144 | A-D Test Statistic                                                                                                                       |   | 0.655  | Anderson-Darling Gamma GOF Test                                 |                                  |   |   |       |   |   |   |  |
| 145 | 5% A-D Critical Value                                                                                                                    |   | 0.786  | Detected data appear Gamma Distributed at 5% Significance Level |                                  |   |   |       |   |   |   |  |
| 146 | K-S Test Statistic                                                                                                                       |   | 0.141  | Kolmogorov-Smirnov Gamma GOF Test                               |                                  |   |   |       |   |   |   |  |
| 147 | 5% K-S Critical Value                                                                                                                    |   | 0.169  | Detected data appear Gamma Distributed at 5% Significance Level |                                  |   |   |       |   |   |   |  |
| 148 | Detected data appear Gamma Distributed at 5% Significance Level                                                                          |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 149 |                                                                                                                                          |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 150 | Gamma Statistics                                                                                                                         |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 151 | k hat (MLE)                                                                                                                              |   | 0.728  | k star (bias corrected MLE)                                     |                                  |   |   | 0.675 |   |   |   |  |
| 152 | Theta hat (MLE)                                                                                                                          |   | 102.4  | Theta star (bias corrected MLE)                                 |                                  |   |   | 110.3 |   |   |   |  |
| 153 | nu hat (MLE)                                                                                                                             |   | 42.2   | nu star (bias corrected)                                        |                                  |   |   | 39.17 |   |   |   |  |
| 154 | MLE Mean (bias corrected)                                                                                                                |   | 74.49  | MLE Sd (bias corrected)                                         |                                  |   |   | 90.65 |   |   |   |  |
| 155 |                                                                                                                                          |   |        | Approximate Chi Square Value (0.05)                             |                                  |   |   | 25.83 |   |   |   |  |
| 156 | Adjusted Level of Significance                                                                                                           |   | 0.0407 | Adjusted Chi Square Value                                       |                                  |   |   | 25.18 |   |   |   |  |
| 157 |                                                                                                                                          |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 158 | Assuming Gamma Distribution                                                                                                              |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 159 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   | 112.9  | 95% Adjusted Gamma UCL (use when n<50)                          |                                  |   |   | 115.8 |   |   |   |  |
| 160 |                                                                                                                                          |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 161 | Lognormal GOF Test                                                                                                                       |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 162 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.951  | Shapiro Wilk Lognormal GOF Test                                 |                                  |   |   |       |   |   |   |  |
| 163 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.926  | Data appear Lognormal at 5% Significance Level                  |                                  |   |   |       |   |   |   |  |
| 164 | Lilliefors Test Statistic                                                                                                                |   | 0.112  | Lilliefors Lognormal GOF Test                                   |                                  |   |   |       |   |   |   |  |
| 165 | 5% Lilliefors Critical Value                                                                                                             |   | 0.161  | Data appear Lognormal at 5% Significance Level                  |                                  |   |   |       |   |   |   |  |
| 166 | Data appear Lognormal at 5% Significance Level                                                                                           |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 167 |                                                                                                                                          |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 168 | Lognormal Statistics                                                                                                                     |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 169 | Minimum of Logged Data                                                                                                                   |   | -0.562 | Mean of logged Data                                             |                                  |   |   | 3.484 |   |   |   |  |
| 170 | Maximum of Logged Data                                                                                                                   |   | 5.805  | SD of logged Data                                               |                                  |   |   | 1.467 |   |   |   |  |
| 171 |                                                                                                                                          |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 172 | Assuming Lognormal Distribution                                                                                                          |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 173 | 95% H-UCL                                                                                                                                |   | 225.8  | 90% Chebyshev (MVUE) UCL                                        |                                  |   |   | 180.2 |   |   |   |  |
| 174 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 221.5  | 97.5% Chebyshev (MVUE) UCL                                      |                                  |   |   | 278.8 |   |   |   |  |
| 175 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 391.3  |                                                                 |                                  |   |   |       |   |   |   |  |
| 176 |                                                                                                                                          |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 177 | Nonparametric Distribution Free UCL Statistics                                                                                           |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 178 | Data appear to follow a Discernible Distribution at 5% Significance Level                                                                |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 179 |                                                                                                                                          |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 180 | Nonparametric Distribution Free UCLs                                                                                                     |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 181 | 95% CLT UCL                                                                                                                              |   | 102.4  | 95% Jackknife UCL                                               |                                  |   |   | 103.4 |   |   |   |  |
| 182 | 95% Standard Bootstrap UCL                                                                                                               |   | 101.8  | 95% Bootstrap-t UCL                                             |                                  |   |   | 112.3 |   |   |   |  |
| 183 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 109.2  | 95% Percentile Bootstrap UCL                                    |                                  |   |   | 103.2 |   |   |   |  |
| 184 | 95% BCA Bootstrap UCL                                                                                                                    |   | 106.8  |                                                                 |                                  |   |   |       |   |   |   |  |
| 185 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 125.4  | 95% Chebyshev(Mean, Sd) UCL                                     |                                  |   |   | 148.5 |   |   |   |  |
| 186 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 180.5  | 99% Chebyshev(Mean, Sd) UCL                                     |                                  |   |   | 243.4 |   |   |   |  |
| 187 |                                                                                                                                          |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 188 | Suggested UCL to Use                                                                                                                     |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 189 | 95% Adjusted Gamma UCL                                                                                                                   |   | 115.8  |                                                                 |                                  |   |   |       |   |   |   |  |
| 190 |                                                                                                                                          |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 191 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 192 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 193 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 194 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 195 |                                                                                                                                          |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 196 |                                                                                                                                          |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 197 | Result (eu1_arsenic_overbank)                                                                                                            |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 198 |                                                                                                                                          |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 199 | General Statistics                                                                                                                       |   |        |                                                                 |                                  |   |   |       |   |   |   |  |
| 200 | Total Number of Observations                                                                                                             |   | 29     | Number of Distinct Observations                                 |                                  |   |   | 28    |   |   |   |  |
| 201 |                                                                                                                                          |   |        | Number of Missing Observations                                  |                                  |   |   | 0     |   |   |   |  |

| A   | B                                                                                                                            | C | D | E                                          | F      | G | H | I | J | K                                                               | L     |
|-----|------------------------------------------------------------------------------------------------------------------------------|---|---|--------------------------------------------|--------|---|---|---|---|-----------------------------------------------------------------|-------|
| 202 |                                                                                                                              |   |   | Minimum                                    | 16.3   |   |   |   |   | Mean                                                            | 63.33 |
| 203 |                                                                                                                              |   |   | Maximum                                    | 176    |   |   |   |   | Median                                                          | 55.4  |
| 204 |                                                                                                                              |   |   | SD                                         | 35.73  |   |   |   |   | Std. Error of Mean                                              | 6.634 |
| 205 |                                                                                                                              |   |   | Coefficient of Variation                   | 0.564  |   |   |   |   | Skewness                                                        | 1.362 |
| 206 |                                                                                                                              |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 207 | <b>Normal GOF Test</b>                                                                                                       |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 208 |                                                                                                                              |   |   | Shapiro Wilk Test Statistic                | 0.876  |   |   |   |   | <b>Shapiro Wilk GOF Test</b>                                    |       |
| 209 |                                                                                                                              |   |   | 5% Shapiro Wilk Critical Value             | 0.926  |   |   |   |   | Data Not Normal at 5% Significance Level                        |       |
| 210 |                                                                                                                              |   |   | Lilliefors Test Statistic                  | 0.225  |   |   |   |   | <b>Lilliefors GOF Test</b>                                      |       |
| 211 |                                                                                                                              |   |   | 5% Lilliefors Critical Value               | 0.161  |   |   |   |   | Data Not Normal at 5% Significance Level                        |       |
| 212 | <b>Data Not Normal at 5% Significance Level</b>                                                                              |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 213 |                                                                                                                              |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 214 | <b>Assuming Normal Distribution</b>                                                                                          |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 215 |                                                                                                                              |   |   | <b>95% Normal UCL</b>                      |        |   |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b>                         |       |
| 216 |                                                                                                                              |   |   | 95% Student's-t UCL                        | 74.61  |   |   |   |   | 95% Adjusted-CLT UCL (Chen-1995)                                | 76.03 |
| 217 |                                                                                                                              |   |   |                                            |        |   |   |   |   | 95% Modified-t UCL (Johnson-1978)                               | 74.89 |
| 218 |                                                                                                                              |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 219 | <b>Gamma GOF Test</b>                                                                                                        |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 220 |                                                                                                                              |   |   | A-D Test Statistic                         | 0.505  |   |   |   |   | <b>Anderson-Darling Gamma GOF Test</b>                          |       |
| 221 |                                                                                                                              |   |   | 5% A-D Critical Value                      | 0.751  |   |   |   |   | Detected data appear Gamma Distributed at 5% Significance Level |       |
| 222 |                                                                                                                              |   |   | K-S Test Statistic                         | 0.159  |   |   |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |       |
| 223 |                                                                                                                              |   |   | 5% K-S Critical Value                      | 0.164  |   |   |   |   | Detected data appear Gamma Distributed at 5% Significance Level |       |
| 224 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                       |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 225 |                                                                                                                              |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 226 | <b>Gamma Statistics</b>                                                                                                      |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 227 |                                                                                                                              |   |   | k hat (MLE)                                | 3.761  |   |   |   |   | k star (bias corrected MLE)                                     | 3.395 |
| 228 |                                                                                                                              |   |   | Theta hat (MLE)                            | 16.84  |   |   |   |   | Theta star (bias corrected MLE)                                 | 18.65 |
| 229 |                                                                                                                              |   |   | nu hat (MLE)                               | 218.2  |   |   |   |   | nu star (bias corrected)                                        | 196.9 |
| 230 |                                                                                                                              |   |   | MLE Mean (bias corrected)                  | 63.33  |   |   |   |   | MLE Sd (bias corrected)                                         | 34.37 |
| 231 |                                                                                                                              |   |   |                                            |        |   |   |   |   | Approximate Chi Square Value (0.05)                             | 165.4 |
| 232 |                                                                                                                              |   |   | Adjusted Level of Significance             | 0.0407 |   |   |   |   | Adjusted Chi Square Value                                       | 163.7 |
| 233 |                                                                                                                              |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 234 | <b>Assuming Gamma Distribution</b>                                                                                           |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 235 |                                                                                                                              |   |   | 95% Approximate Gamma UCL (use when n>=50) | 75.37  |   |   |   |   | 95% Adjusted Gamma UCL (use when n<50)                          | 76.16 |
| 236 |                                                                                                                              |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 237 | <b>Lognormal GOF Test</b>                                                                                                    |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 238 |                                                                                                                              |   |   | Shapiro Wilk Test Statistic                | 0.979  |   |   |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |       |
| 239 |                                                                                                                              |   |   | 5% Shapiro Wilk Critical Value             | 0.926  |   |   |   |   | Data appear Lognormal at 5% Significance Level                  |       |
| 240 |                                                                                                                              |   |   | Lilliefors Test Statistic                  | 0.124  |   |   |   |   | <b>Lilliefors Lognormal GOF Test</b>                            |       |
| 241 |                                                                                                                              |   |   | 5% Lilliefors Critical Value               | 0.161  |   |   |   |   | Data appear Lognormal at 5% Significance Level                  |       |
| 242 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                        |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 243 |                                                                                                                              |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 244 | <b>Lognormal Statistics</b>                                                                                                  |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 245 |                                                                                                                              |   |   | Minimum of Logged Data                     | 2.791  |   |   |   |   | Mean of logged Data                                             | 4.01  |
| 246 |                                                                                                                              |   |   | Maximum of Logged Data                     | 5.17   |   |   |   |   | SD of logged Data                                               | 0.534 |
| 247 |                                                                                                                              |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 248 | <b>Assuming Lognormal Distribution</b>                                                                                       |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 249 |                                                                                                                              |   |   | 95% H-UCL                                  | 77.61  |   |   |   |   | 90% Chebyshev (MVUE) UCL                                        | 82.98 |
| 250 |                                                                                                                              |   |   | 95% Chebyshev (MVUE) UCL                   | 91.92  |   |   |   |   | 97.5% Chebyshev (MVUE) UCL                                      | 104.3 |
| 251 |                                                                                                                              |   |   | 99% Chebyshev (MVUE) UCL                   | 128.7  |   |   |   |   |                                                                 |       |
| 252 |                                                                                                                              |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 253 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                        |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 254 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                             |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 255 |                                                                                                                              |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 256 | <b>Nonparametric Distribution Free UCLs</b>                                                                                  |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 257 |                                                                                                                              |   |   | 95% CLT UCL                                | 74.24  |   |   |   |   | 95% Jackknife UCL                                               | 74.61 |
| 258 |                                                                                                                              |   |   | 95% Standard Bootstrap UCL                 | 73.95  |   |   |   |   | 95% Bootstrap-t UCL                                             | 77.34 |
| 259 |                                                                                                                              |   |   | 95% Hall's Bootstrap UCL                   | 77.96  |   |   |   |   | 95% Percentile Bootstrap UCL                                    | 74.47 |
| 260 |                                                                                                                              |   |   | 95% BCA Bootstrap UCL                      | 75.72  |   |   |   |   |                                                                 |       |
| 261 |                                                                                                                              |   |   | 90% Chebyshev(Mean, Sd) UCL                | 83.23  |   |   |   |   | 95% Chebyshev(Mean, Sd) UCL                                     | 92.25 |
| 262 |                                                                                                                              |   |   | 97.5% Chebyshev(Mean, Sd) UCL              | 104.8  |   |   |   |   | 99% Chebyshev(Mean, Sd) UCL                                     | 129.3 |
| 263 |                                                                                                                              |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 264 | <b>Suggested UCL to Use</b>                                                                                                  |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 265 |                                                                                                                              |   |   | 95% Adjusted Gamma UCL                     | 76.16  |   |   |   |   |                                                                 |       |
| 266 |                                                                                                                              |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 267 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. |   |   |                                            |        |   |   |   |   |                                                                 |       |
| 268 | Recommendations are based upon data size, data distribution, and skewness.                                                   |   |   |                                            |        |   |   |   |   |                                                                 |       |

| A   | B                                                                                                                                        | C      | D                                                   | E | F                                       | G | H | I | J | K | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------|---|-----------------------------------------|---|---|---|---|---|---|
| 269 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |                                                     |   |                                         |   |   |   |   |   |   |
| 270 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |                                                     |   |                                         |   |   |   |   |   |   |
| 271 |                                                                                                                                          |        |                                                     |   |                                         |   |   |   |   |   |   |
| 272 |                                                                                                                                          |        |                                                     |   |                                         |   |   |   |   |   |   |
| 273 | <b>Result (eu1_arsenic_waste rock)</b>                                                                                                   |        |                                                     |   |                                         |   |   |   |   |   |   |
| 274 |                                                                                                                                          |        |                                                     |   |                                         |   |   |   |   |   |   |
| 275 | <b>General Statistics</b>                                                                                                                |        |                                                     |   |                                         |   |   |   |   |   |   |
| 276 | Total Number of Observations                                                                                                             | 29     | Number of Distinct Observations                     |   | 28                                      |   |   |   |   |   |   |
| 277 |                                                                                                                                          |        | Number of Missing Observations                      |   | 0                                       |   |   |   |   |   |   |
| 278 | Minimum                                                                                                                                  | 30.4   | Mean                                                |   | 209.8                                   |   |   |   |   |   |   |
| 279 | Maximum                                                                                                                                  | 729    | Median                                              |   | 150                                     |   |   |   |   |   |   |
| 280 | SD                                                                                                                                       | 166.6  | Std. Error of Mean                                  |   | 30.93                                   |   |   |   |   |   |   |
| 281 | Coefficient of Variation                                                                                                                 | 0.794  | Skewness                                            |   | 2.129                                   |   |   |   |   |   |   |
| 282 |                                                                                                                                          |        |                                                     |   |                                         |   |   |   |   |   |   |
| 283 | <b>Normal GOF Test</b>                                                                                                                   |        |                                                     |   |                                         |   |   |   |   |   |   |
| 284 | Shapiro Wilk Test Statistic                                                                                                              | 0.736  | <b>Shapiro Wilk GOF Test</b>                        |   |                                         |   |   |   |   |   |   |
| 285 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.926  | Data Not Normal at 5% Significance Level            |   |                                         |   |   |   |   |   |   |
| 286 | Lilliefors Test Statistic                                                                                                                | 0.24   | <b>Lilliefors GOF Test</b>                          |   |                                         |   |   |   |   |   |   |
| 287 | 5% Lilliefors Critical Value                                                                                                             | 0.161  | Data Not Normal at 5% Significance Level            |   |                                         |   |   |   |   |   |   |
| 288 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |        |                                                     |   |                                         |   |   |   |   |   |   |
| 289 |                                                                                                                                          |        |                                                     |   |                                         |   |   |   |   |   |   |
| 290 | <b>Assuming Normal Distribution</b>                                                                                                      |        |                                                     |   |                                         |   |   |   |   |   |   |
| 291 | <b>95% Normal UCL</b>                                                                                                                    |        |                                                     |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |   |   |   |   |   |
| 292 | 95% Student's-t UCL                                                                                                                      | 262.4  | 95% Adjusted-CLT UCL (Chen-1995)                    |   | 273.7                                   |   |   |   |   |   |   |
| 293 |                                                                                                                                          |        | 95% Modified-t UCL (Johnson-1978)                   |   | 264.5                                   |   |   |   |   |   |   |
| 294 |                                                                                                                                          |        |                                                     |   |                                         |   |   |   |   |   |   |
| 295 | <b>Gamma GOF Test</b>                                                                                                                    |        |                                                     |   |                                         |   |   |   |   |   |   |
| 296 | A-D Test Statistic                                                                                                                       | 1.097  | <b>Anderson-Darling Gamma GOF Test</b>              |   |                                         |   |   |   |   |   |   |
| 297 | 5% A-D Critical Value                                                                                                                    | 0.756  | Data Not Gamma Distributed at 5% Significance Level |   |                                         |   |   |   |   |   |   |
| 298 | K-S Test Statistic                                                                                                                       | 0.179  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |                                         |   |   |   |   |   |   |
| 299 | 5% K-S Critical Value                                                                                                                    | 0.164  | Data Not Gamma Distributed at 5% Significance Level |   |                                         |   |   |   |   |   |   |
| 300 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |        |                                                     |   |                                         |   |   |   |   |   |   |
| 301 |                                                                                                                                          |        |                                                     |   |                                         |   |   |   |   |   |   |
| 302 | <b>Gamma Statistics</b>                                                                                                                  |        |                                                     |   |                                         |   |   |   |   |   |   |
| 303 | k hat (MLE)                                                                                                                              | 2.378  | k star (bias corrected MLE)                         |   | 2.155                                   |   |   |   |   |   |   |
| 304 | Theta hat (MLE)                                                                                                                          | 88.24  | Theta star (bias corrected MLE)                     |   | 97.37                                   |   |   |   |   |   |   |
| 305 | nu hat (MLE)                                                                                                                             | 137.9  | nu star (bias corrected)                            |   | 125                                     |   |   |   |   |   |   |
| 306 | MLE Mean (bias corrected)                                                                                                                | 209.8  | MLE Sd (bias corrected)                             |   | 142.9                                   |   |   |   |   |   |   |
| 307 |                                                                                                                                          |        | Approximate Chi Square Value (0.05)                 |   | 100.2                                   |   |   |   |   |   |   |
| 308 | Adjusted Level of Significance                                                                                                           | 0.0407 | Adjusted Chi Square Value                           |   | 98.83                                   |   |   |   |   |   |   |
| 309 |                                                                                                                                          |        |                                                     |   |                                         |   |   |   |   |   |   |
| 310 | <b>Assuming Gamma Distribution</b>                                                                                                       |        |                                                     |   |                                         |   |   |   |   |   |   |
| 311 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | 261.8  | 95% Adjusted Gamma UCL (use when n<50)              |   | 265.3                                   |   |   |   |   |   |   |
| 312 |                                                                                                                                          |        |                                                     |   |                                         |   |   |   |   |   |   |
| 313 | <b>Lognormal GOF Test</b>                                                                                                                |        |                                                     |   |                                         |   |   |   |   |   |   |
| 314 | Shapiro Wilk Test Statistic                                                                                                              | 0.945  | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |                                         |   |   |   |   |   |   |
| 315 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.926  | Data appear Lognormal at 5% Significance Level      |   |                                         |   |   |   |   |   |   |
| 316 | Lilliefors Test Statistic                                                                                                                | 0.148  | <b>Lilliefors Lognormal GOF Test</b>                |   |                                         |   |   |   |   |   |   |
| 317 | 5% Lilliefors Critical Value                                                                                                             | 0.161  | Data appear Lognormal at 5% Significance Level      |   |                                         |   |   |   |   |   |   |
| 318 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |        |                                                     |   |                                         |   |   |   |   |   |   |
| 319 |                                                                                                                                          |        |                                                     |   |                                         |   |   |   |   |   |   |
| 320 | <b>Lognormal Statistics</b>                                                                                                              |        |                                                     |   |                                         |   |   |   |   |   |   |
| 321 | Minimum of Logged Data                                                                                                                   | 3.414  | Mean of logged Data                                 |   | 5.121                                   |   |   |   |   |   |   |
| 322 | Maximum of Logged Data                                                                                                                   | 6.592  | SD of logged Data                                   |   | 0.662                                   |   |   |   |   |   |   |
| 323 |                                                                                                                                          |        |                                                     |   |                                         |   |   |   |   |   |   |
| 324 | <b>Assuming Lognormal Distribution</b>                                                                                                   |        |                                                     |   |                                         |   |   |   |   |   |   |
| 325 | 95% H-UCL                                                                                                                                | 271    | 90% Chebyshev (MVUE) UCL                            |   | 288.5                                   |   |   |   |   |   |   |
| 326 | 95% Chebyshev (MVUE) UCL                                                                                                                 | 325.5  | 97.5% Chebyshev (MVUE) UCL                          |   | 377                                     |   |   |   |   |   |   |
| 327 | 99% Chebyshev (MVUE) UCL                                                                                                                 | 478    |                                                     |   |                                         |   |   |   |   |   |   |
| 328 |                                                                                                                                          |        |                                                     |   |                                         |   |   |   |   |   |   |
| 329 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |                                                     |   |                                         |   |   |   |   |   |   |
| 330 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |        |                                                     |   |                                         |   |   |   |   |   |   |
| 331 |                                                                                                                                          |        |                                                     |   |                                         |   |   |   |   |   |   |
| 332 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |        |                                                     |   |                                         |   |   |   |   |   |   |
| 333 | 95% CLT UCL                                                                                                                              | 260.7  | 95% Jackknife UCL                                   |   | 262.4                                   |   |   |   |   |   |   |
| 334 | 95% Standard Bootstrap UCL                                                                                                               | 259.4  | 95% Bootstrap-t UCL                                 |   | 288.9                                   |   |   |   |   |   |   |
| 335 | 95% Hall's Bootstrap UCL                                                                                                                 | 318    | 95% Percentile Bootstrap UCL                        |   | 263.8                                   |   |   |   |   |   |   |

| A   | B                                                                                                                                        | C | D | E | F     | G                                                            | H | I | J | K      | L |  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|-------|--------------------------------------------------------------|---|---|---|--------|---|--|
| 336 | 95% BCA Bootstrap UCL                                                                                                                    |   |   |   | 271.4 |                                                              |   |   |   |        |   |  |
| 337 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   |   | 302.6 | 95% Chebyshev(Mean, Sd) UCL                                  |   |   |   | 344.6  |   |  |
| 338 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   |   | 403   | 99% Chebyshev(Mean, Sd) UCL                                  |   |   |   | 517.6  |   |  |
| 339 |                                                                                                                                          |   |   |   |       |                                                              |   |   |   |        |   |  |
| 340 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |   |       |                                                              |   |   |   |        |   |  |
| 341 | 95% H-UCL                                                                                                                                |   |   |   | 271   |                                                              |   |   |   |        |   |  |
| 342 |                                                                                                                                          |   |   |   |       |                                                              |   |   |   |        |   |  |
| 343 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |   |       |                                                              |   |   |   |        |   |  |
| 344 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |   |       |                                                              |   |   |   |        |   |  |
| 345 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |   |       |                                                              |   |   |   |        |   |  |
| 346 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |   |       |                                                              |   |   |   |        |   |  |
| 347 |                                                                                                                                          |   |   |   |       |                                                              |   |   |   |        |   |  |
| 348 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |   |   |   |       |                                                              |   |   |   |        |   |  |
| 349 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |   |   |   |       |                                                              |   |   |   |        |   |  |
| 350 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |   |   |   |       |                                                              |   |   |   |        |   |  |
| 351 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |   |   |   |       |                                                              |   |   |   |        |   |  |
| 352 |                                                                                                                                          |   |   |   |       |                                                              |   |   |   |        |   |  |
| 353 | <b>Result (eu1_cadmium_overbank)</b>                                                                                                     |   |   |   |       |                                                              |   |   |   |        |   |  |
| 354 |                                                                                                                                          |   |   |   |       |                                                              |   |   |   |        |   |  |
| 355 | <b>General Statistics</b>                                                                                                                |   |   |   |       |                                                              |   |   |   |        |   |  |
| 356 | Total Number of Observations                                                                                                             |   |   |   | 29    | Number of Distinct Observations                              |   |   |   | 26     |   |  |
| 357 | Number of Detects                                                                                                                        |   |   |   | 27    | Number of Non-Detects                                        |   |   |   | 2      |   |  |
| 358 | Number of Distinct Detects                                                                                                               |   |   |   | 24    | Number of Distinct Non-Detects                               |   |   |   | 2      |   |  |
| 359 | Minimum Detect                                                                                                                           |   |   |   | 0.68  | Minimum Non-Detect                                           |   |   |   | 0.052  |   |  |
| 360 | Maximum Detect                                                                                                                           |   |   |   | 216   | Maximum Non-Detect                                           |   |   |   | 0.053  |   |  |
| 361 | Variance Detects                                                                                                                         |   |   |   | 1674  | Percent Non-Detects                                          |   |   |   | 6.897% |   |  |
| 362 | Mean Detects                                                                                                                             |   |   |   | 12.61 | SD Detects                                                   |   |   |   | 40.91  |   |  |
| 363 | Median Detects                                                                                                                           |   |   |   | 3.1   | CV Detects                                                   |   |   |   | 3.245  |   |  |
| 364 | Skewness Detects                                                                                                                         |   |   |   | 5.091 | Kurtosis Detects                                             |   |   |   | 26.23  |   |  |
| 365 | Mean of Logged Detects                                                                                                                   |   |   |   | 1.273 | SD of Logged Detects                                         |   |   |   | 1.254  |   |  |
| 366 |                                                                                                                                          |   |   |   |       |                                                              |   |   |   |        |   |  |
| 367 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |   |   |       |                                                              |   |   |   |        |   |  |
| 368 | Shapiro Wilk Test Statistic                                                                                                              |   |   |   | 0.28  | <b>Shapiro Wilk GOF Test</b>                                 |   |   |   |        |   |  |
| 369 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   |   | 0.923 | Detected Data Not Normal at 5% Significance Level            |   |   |   |        |   |  |
| 370 | Lilliefors Test Statistic                                                                                                                |   |   |   | 0.431 | <b>Lilliefors GOF Test</b>                                   |   |   |   |        |   |  |
| 371 | 5% Lilliefors Critical Value                                                                                                             |   |   |   | 0.167 | Detected Data Not Normal at 5% Significance Level            |   |   |   |        |   |  |
| 372 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |   |   |   |       |                                                              |   |   |   |        |   |  |
| 373 |                                                                                                                                          |   |   |   |       |                                                              |   |   |   |        |   |  |
| 374 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |   |   |       |                                                              |   |   |   |        |   |  |
| 375 | KM Mean                                                                                                                                  |   |   |   | 11.74 | KM Standard Error of Mean                                    |   |   |   | 7.355  |   |  |
| 376 | KM SD                                                                                                                                    |   |   |   | 38.87 | 95% KM (BCA) UCL                                             |   |   |   | 26.43  |   |  |
| 377 | 95% KM (t) UCL                                                                                                                           |   |   |   | 24.25 | 95% KM (Percentile Bootstrap) UCL                            |   |   |   | 26.35  |   |  |
| 378 | 95% KM (z) UCL                                                                                                                           |   |   |   | 23.84 | 95% KM Bootstrap t UCL                                       |   |   |   | 95.87  |   |  |
| 379 | 90% KM Chebyshev UCL                                                                                                                     |   |   |   | 33.81 | 95% KM Chebyshev UCL                                         |   |   |   | 43.8   |   |  |
| 380 | 97.5% KM Chebyshev UCL                                                                                                                   |   |   |   | 57.67 | 99% KM Chebyshev UCL                                         |   |   |   | 84.92  |   |  |
| 381 |                                                                                                                                          |   |   |   |       |                                                              |   |   |   |        |   |  |
| 382 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |   |   |   |       |                                                              |   |   |   |        |   |  |
| 383 | A-D Test Statistic                                                                                                                       |   |   |   | 3.04  | <b>Anderson-Darling GOF Test</b>                             |   |   |   |        |   |  |
| 384 | 5% A-D Critical Value                                                                                                                    |   |   |   | 0.807 | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |   |        |   |  |
| 385 | K-S Test Statistic                                                                                                                       |   |   |   | 0.225 | <b>Kolmogorov-Smirnov GOF</b>                                |   |   |   |        |   |  |
| 386 | 5% K-S Critical Value                                                                                                                    |   |   |   | 0.178 | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |   |        |   |  |
| 387 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                                      |   |   |   |       |                                                              |   |   |   |        |   |  |
| 388 |                                                                                                                                          |   |   |   |       |                                                              |   |   |   |        |   |  |
| 389 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |   |   |   |       |                                                              |   |   |   |        |   |  |
| 390 | k hat (MLE)                                                                                                                              |   |   |   | 0.503 | k star (bias corrected MLE)                                  |   |   |   | 0.472  |   |  |
| 391 | Theta hat (MLE)                                                                                                                          |   |   |   | 25.06 | Theta star (bias corrected MLE)                              |   |   |   | 26.72  |   |  |
| 392 | nu hat (MLE)                                                                                                                             |   |   |   | 27.16 | nu star (bias corrected)                                     |   |   |   | 25.48  |   |  |
| 393 | Mean (detects)                                                                                                                           |   |   |   | 12.61 |                                                              |   |   |   |        |   |  |
| 394 |                                                                                                                                          |   |   |   |       |                                                              |   |   |   |        |   |  |
| 395 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |   |   |   |       |                                                              |   |   |   |        |   |  |
| 396 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |   |   |   |       |                                                              |   |   |   |        |   |  |
| 397 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |   |   |   |       |                                                              |   |   |   |        |   |  |
| 398 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |   |   |   |       |                                                              |   |   |   |        |   |  |
| 399 | This is especially true when the sample size is small.                                                                                   |   |   |   |       |                                                              |   |   |   |        |   |  |
| 400 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |   |   |   |       |                                                              |   |   |   |        |   |  |
| 401 | Minimum                                                                                                                                  |   |   |   | 0.01  | Mean                                                         |   |   |   | 11.74  |   |  |
| 402 | Maximum                                                                                                                                  |   |   |   | 216   | Median                                                       |   |   |   | 2.6    |   |  |

| A   | B | C | D | E                                                                                                                                        | F      | G | H | I                           | J | K                                                       | L     |
|-----|---|---|---|------------------------------------------------------------------------------------------------------------------------------------------|--------|---|---|-----------------------------|---|---------------------------------------------------------|-------|
| 403 |   |   |   | SD                                                                                                                                       | 39.56  |   |   |                             |   | CV                                                      | 3.37  |
| 404 |   |   |   | k hat (MLE)                                                                                                                              | 0.411  |   |   |                             |   | k star (bias corrected MLE)                             | 0.391 |
| 405 |   |   |   | Theta hat (MLE)                                                                                                                          | 28.58  |   |   |                             |   | Theta star (bias corrected MLE)                         | 30    |
| 406 |   |   |   | nu hat (MLE)                                                                                                                             | 23.82  |   |   |                             |   | nu star (bias corrected)                                | 22.69 |
| 407 |   |   |   | Adjusted Level of Significance ( $\beta$ )                                                                                               | 0.0407 |   |   |                             |   |                                                         |       |
| 408 |   |   |   | Approximate Chi Square Value (22.69, $\alpha$ )                                                                                          | 12.86  |   |   |                             |   | Adjusted Chi Square Value (22.69, $\beta$ )             | 12.41 |
| 409 |   |   |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                                        | 20.71  |   |   |                             |   | 95% Gamma Adjusted UCL (use when $n < 50$ )             | 21.45 |
| 410 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                         |       |
| 411 |   |   |   | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |        |   |   |                             |   |                                                         |       |
| 412 |   |   |   | Mean (KM)                                                                                                                                | 11.74  |   |   |                             |   | SD (KM)                                                 | 38.87 |
| 413 |   |   |   | Variance (KM)                                                                                                                            | 1511   |   |   |                             |   | SE of Mean (KM)                                         | 7.355 |
| 414 |   |   |   | k hat (KM)                                                                                                                               | 0.0912 |   |   |                             |   | k star (KM)                                             | 0.105 |
| 415 |   |   |   | nu hat (KM)                                                                                                                              | 5.292  |   |   |                             |   | nu star (KM)                                            | 6.078 |
| 416 |   |   |   | theta hat (KM)                                                                                                                           | 128.7  |   |   |                             |   | theta star (KM)                                         | 112   |
| 417 |   |   |   | 80% gamma percentile (KM)                                                                                                                | 8.701  |   |   |                             |   | 90% gamma percentile (KM)                               | 31.83 |
| 418 |   |   |   | 95% gamma percentile (KM)                                                                                                                | 67.93  |   |   |                             |   | 99% gamma percentile (KM)                               | 182.2 |
| 419 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                         |       |
| 420 |   |   |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |        |   |   |                             |   |                                                         |       |
| 421 |   |   |   | Approximate Chi Square Value (6.08, $\alpha$ )                                                                                           | 1.68   |   |   |                             |   | Adjusted Chi Square Value (6.08, $\beta$ )              | 1.546 |
| 422 |   |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                      | 42.48  |   |   |                             |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )          | 46.15 |
| 423 |   |   |   | 95% Gamma Adjusted KM-UCL (use when $k \leq 1$ and $15 < n < 50$ )                                                                       |        |   |   |                             |   |                                                         |       |
| 424 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                         |       |
| 425 |   |   |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |        |   |   |                             |   |                                                         |       |
| 426 |   |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.891  |   |   |                             |   | <b>Shapiro Wilk GOF Test</b>                            |       |
| 427 |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                           | 0.923  |   |   |                             |   | Detected Data Not Lognormal at 5% Significance Level    |       |
| 428 |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.13   |   |   |                             |   | <b>Lilliefors GOF Test</b>                              |       |
| 429 |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.167  |   |   |                             |   | Detected Data appear Lognormal at 5% Significance Level |       |
| 430 |   |   |   | <b>Detected Data appear Approximate Lognormal at 5% Significance Level</b>                                                               |        |   |   |                             |   |                                                         |       |
| 431 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                         |       |
| 432 |   |   |   | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |        |   |   |                             |   |                                                         |       |
| 433 |   |   |   | Mean in Original Scale                                                                                                                   | 11.75  |   |   |                             |   | Mean in Log Scale                                       | 1.077 |
| 434 |   |   |   | SD in Original Scale                                                                                                                     | 39.55  |   |   |                             |   | SD in Log Scale                                         | 1.413 |
| 435 |   |   |   | 95% t UCL (assumes normality of ROS data)                                                                                                | 24.25  |   |   |                             |   | 95% Percentile Bootstrap UCL                            | 26.2  |
| 436 |   |   |   | 95% BCA Bootstrap UCL                                                                                                                    | 36.03  |   |   |                             |   | 95% Bootstrap t UCL                                     | 98.54 |
| 437 |   |   |   | 95% H-UCL (Log ROS)                                                                                                                      | 17.85  |   |   |                             |   |                                                         |       |
| 438 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                         |       |
| 439 |   |   |   | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |        |   |   |                             |   |                                                         |       |
| 440 |   |   |   | KM Mean (logged)                                                                                                                         | 0.981  |   |   |                             |   | KM Geo Mean                                             | 2.667 |
| 441 |   |   |   | KM SD (logged)                                                                                                                           | 1.599  |   |   |                             |   | 95% Critical H Value (KM-Log)                           | 3.294 |
| 442 |   |   |   | KM Standard Error of Mean (logged)                                                                                                       | 0.303  |   |   |                             |   | 95% H-UCL (KM -Log)                                     | 25.94 |
| 443 |   |   |   | KM SD (logged)                                                                                                                           | 1.599  |   |   |                             |   | 95% Critical H Value (KM-Log)                           | 3.294 |
| 444 |   |   |   | KM Standard Error of Mean (logged)                                                                                                       | 0.303  |   |   |                             |   |                                                         |       |
| 445 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                         |       |
| 446 |   |   |   | <b>DL/2 Statistics</b>                                                                                                                   |        |   |   |                             |   |                                                         |       |
| 447 |   |   |   | <b>DL/2 Normal</b>                                                                                                                       |        |   |   | <b>DL/2 Log-Transformed</b> |   |                                                         |       |
| 448 |   |   |   | Mean in Original Scale                                                                                                                   | 11.74  |   |   |                             |   | Mean in Log Scale                                       | 0.934 |
| 449 |   |   |   | SD in Original Scale                                                                                                                     | 39.56  |   |   |                             |   | SD in Log Scale                                         | 1.751 |
| 450 |   |   |   | 95% t UCL (Assumes normality)                                                                                                            | 24.23  |   |   |                             |   | 95% H-Stat UCL                                          | 37.8  |
| 451 |   |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |        |   |   |                             |   |                                                         |       |
| 452 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                         |       |
| 453 |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |   |   |                             |   |                                                         |       |
| 454 |   |   |   | <b>Detected Data appear Approximate Lognormal Distributed at 5% Significance Level</b>                                                   |        |   |   |                             |   |                                                         |       |
| 455 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                         |       |
| 456 |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |        |   |   |                             |   |                                                         |       |
| 457 |   |   |   | KM H-UCL                                                                                                                                 | 25.94  |   |   |                             |   |                                                         |       |
| 458 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                         |       |
| 459 |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |   |   |                             |   |                                                         |       |
| 460 |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |   |   |                             |   |                                                         |       |
| 461 |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |   |   |                             |   |                                                         |       |
| 462 |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |   |   |                             |   |                                                         |       |
| 463 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                         |       |
| 464 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                         |       |
| 465 |   |   |   | <b>Result (eu1_cadmium_waste rock)</b>                                                                                                   |        |   |   |                             |   |                                                         |       |
| 466 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                         |       |
| 467 |   |   |   | <b>General Statistics</b>                                                                                                                |        |   |   |                             |   |                                                         |       |
| 468 |   |   |   | Total Number of Observations                                                                                                             | 29     |   |   |                             |   | Number of Distinct Observations                         | 28    |
| 469 |   |   |   |                                                                                                                                          |        |   |   |                             |   | Number of Missing Observations                          | 0     |

| A   | B | C | D | E                                                                                                                            | F      | G | H | I                                       | J | K                                                               | L     |
|-----|---|---|---|------------------------------------------------------------------------------------------------------------------------------|--------|---|---|-----------------------------------------|---|-----------------------------------------------------------------|-------|
| 470 |   |   |   | Minimum                                                                                                                      | 0.68   |   |   |                                         |   | Mean                                                            | 16.6  |
| 471 |   |   |   | Maximum                                                                                                                      | 95.8   |   |   |                                         |   | Median                                                          | 8.6   |
| 472 |   |   |   | SD                                                                                                                           | 21.33  |   |   |                                         |   | Std. Error of Mean                                              | 3.96  |
| 473 |   |   |   | Coefficient of Variation                                                                                                     | 1.285  |   |   |                                         |   | Skewness                                                        | 2.518 |
| 474 |   |   |   |                                                                                                                              |        |   |   |                                         |   |                                                                 |       |
| 475 |   |   |   | <b>Normal GOF Test</b>                                                                                                       |        |   |   |                                         |   |                                                                 |       |
| 476 |   |   |   | Shapiro Wilk Test Statistic                                                                                                  | 0.701  |   |   |                                         |   | <b>Shapiro Wilk GOF Test</b>                                    |       |
| 477 |   |   |   | 5% Shapiro Wilk Critical Value                                                                                               | 0.926  |   |   |                                         |   | Data Not Normal at 5% Significance Level                        |       |
| 478 |   |   |   | Lilliefors Test Statistic                                                                                                    | 0.228  |   |   |                                         |   | <b>Lilliefors GOF Test</b>                                      |       |
| 479 |   |   |   | 5% Lilliefors Critical Value                                                                                                 | 0.161  |   |   |                                         |   | Data Not Normal at 5% Significance Level                        |       |
| 480 |   |   |   | <b>Data Not Normal at 5% Significance Level</b>                                                                              |        |   |   |                                         |   |                                                                 |       |
| 481 |   |   |   |                                                                                                                              |        |   |   |                                         |   |                                                                 |       |
| 482 |   |   |   | <b>Assuming Normal Distribution</b>                                                                                          |        |   |   |                                         |   |                                                                 |       |
| 483 |   |   |   | <b>95% Normal UCL</b>                                                                                                        |        |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |                                                                 |       |
| 484 |   |   |   | 95% Student's-t UCL                                                                                                          | 23.34  |   |   |                                         |   | 95% Adjusted-CLT UCL (Chen-1995)                                | 25.09 |
| 485 |   |   |   |                                                                                                                              |        |   |   |                                         |   | 95% Modified-t UCL (Johnson-1978)                               | 23.65 |
| 486 |   |   |   |                                                                                                                              |        |   |   |                                         |   |                                                                 |       |
| 487 |   |   |   | <b>Gamma GOF Test</b>                                                                                                        |        |   |   |                                         |   |                                                                 |       |
| 488 |   |   |   | A-D Test Statistic                                                                                                           | 0.326  |   |   |                                         |   | <b>Anderson-Darling Gamma GOF Test</b>                          |       |
| 489 |   |   |   | 5% A-D Critical Value                                                                                                        | 0.781  |   |   |                                         |   | Detected data appear Gamma Distributed at 5% Significance Level |       |
| 490 |   |   |   | K-S Test Statistic                                                                                                           | 0.0888 |   |   |                                         |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |       |
| 491 |   |   |   | 5% K-S Critical Value                                                                                                        | 0.169  |   |   |                                         |   | Detected data appear Gamma Distributed at 5% Significance Level |       |
| 492 |   |   |   | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                       |        |   |   |                                         |   |                                                                 |       |
| 493 |   |   |   |                                                                                                                              |        |   |   |                                         |   |                                                                 |       |
| 494 |   |   |   | <b>Gamma Statistics</b>                                                                                                      |        |   |   |                                         |   |                                                                 |       |
| 495 |   |   |   | k hat (MLE)                                                                                                                  | 0.828  |   |   |                                         |   | k star (bias corrected MLE)                                     | 0.766 |
| 496 |   |   |   | Theta hat (MLE)                                                                                                              | 20.04  |   |   |                                         |   | Theta star (bias corrected MLE)                                 | 21.68 |
| 497 |   |   |   | nu hat (MLE)                                                                                                                 | 48.04  |   |   |                                         |   | nu star (bias corrected)                                        | 44.41 |
| 498 |   |   |   | MLE Mean (bias corrected)                                                                                                    | 16.6   |   |   |                                         |   | MLE Sd (bias corrected)                                         | 18.97 |
| 499 |   |   |   |                                                                                                                              |        |   |   |                                         |   | Approximate Chi Square Value (0.05)                             | 30.12 |
| 500 |   |   |   | Adjusted Level of Significance                                                                                               | 0.0407 |   |   |                                         |   | Adjusted Chi Square Value                                       | 29.42 |
| 501 |   |   |   |                                                                                                                              |        |   |   |                                         |   |                                                                 |       |
| 502 |   |   |   | <b>Assuming Gamma Distribution</b>                                                                                           |        |   |   |                                         |   |                                                                 |       |
| 503 |   |   |   | 95% Approximate Gamma UCL (use when n>=50)                                                                                   | 24.47  |   |   |                                         |   | 95% Adjusted Gamma UCL (use when n<50)                          | 25.06 |
| 504 |   |   |   |                                                                                                                              |        |   |   |                                         |   |                                                                 |       |
| 505 |   |   |   | <b>Lognormal GOF Test</b>                                                                                                    |        |   |   |                                         |   |                                                                 |       |
| 506 |   |   |   | Shapiro Wilk Test Statistic                                                                                                  | 0.969  |   |   |                                         |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |       |
| 507 |   |   |   | 5% Shapiro Wilk Critical Value                                                                                               | 0.926  |   |   |                                         |   | Data appear Lognormal at 5% Significance Level                  |       |
| 508 |   |   |   | Lilliefors Test Statistic                                                                                                    | 0.0999 |   |   |                                         |   | <b>Lilliefors Lognormal GOF Test</b>                            |       |
| 509 |   |   |   | 5% Lilliefors Critical Value                                                                                                 | 0.161  |   |   |                                         |   | Data appear Lognormal at 5% Significance Level                  |       |
| 510 |   |   |   | <b>Data appear Lognormal at 5% Significance Level</b>                                                                        |        |   |   |                                         |   |                                                                 |       |
| 511 |   |   |   |                                                                                                                              |        |   |   |                                         |   |                                                                 |       |
| 512 |   |   |   | <b>Lognormal Statistics</b>                                                                                                  |        |   |   |                                         |   |                                                                 |       |
| 513 |   |   |   | Minimum of Logged Data                                                                                                       | -0.386 |   |   |                                         |   | Mean of logged Data                                             | 2.096 |
| 514 |   |   |   | Maximum of Logged Data                                                                                                       | 4.562  |   |   |                                         |   | SD of logged Data                                               | 1.309 |
| 515 |   |   |   |                                                                                                                              |        |   |   |                                         |   |                                                                 |       |
| 516 |   |   |   | <b>Assuming Lognormal Distribution</b>                                                                                       |        |   |   |                                         |   |                                                                 |       |
| 517 |   |   |   | 95% H-UCL                                                                                                                    | 39.04  |   |   |                                         |   | 90% Chebyshev (MVUE) UCL                                        | 34.39 |
| 518 |   |   |   | 95% Chebyshev (MVUE) UCL                                                                                                     | 41.72  |   |   |                                         |   | 97.5% Chebyshev (MVUE) UCL                                      | 51.89 |
| 519 |   |   |   | 99% Chebyshev (MVUE) UCL                                                                                                     | 71.86  |   |   |                                         |   |                                                                 |       |
| 520 |   |   |   |                                                                                                                              |        |   |   |                                         |   |                                                                 |       |
| 521 |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                        |        |   |   |                                         |   |                                                                 |       |
| 522 |   |   |   | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                             |        |   |   |                                         |   |                                                                 |       |
| 523 |   |   |   |                                                                                                                              |        |   |   |                                         |   |                                                                 |       |
| 524 |   |   |   | <b>Nonparametric Distribution Free UCLs</b>                                                                                  |        |   |   |                                         |   |                                                                 |       |
| 525 |   |   |   | 95% CLT UCL                                                                                                                  | 23.12  |   |   |                                         |   | 95% Jackknife UCL                                               | 23.34 |
| 526 |   |   |   | 95% Standard Bootstrap UCL                                                                                                   | 22.98  |   |   |                                         |   | 95% Bootstrap-t UCL                                             | 29    |
| 527 |   |   |   | 95% Hall's Bootstrap UCL                                                                                                     | 55.78  |   |   |                                         |   | 95% Percentile Bootstrap UCL                                    | 23.34 |
| 528 |   |   |   | 95% BCA Bootstrap UCL                                                                                                        | 25.46  |   |   |                                         |   |                                                                 |       |
| 529 |   |   |   | 90% Chebyshev(Mean, Sd) UCL                                                                                                  | 28.48  |   |   |                                         |   | 95% Chebyshev(Mean, Sd) UCL                                     | 33.86 |
| 530 |   |   |   | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                | 41.33  |   |   |                                         |   | 99% Chebyshev(Mean, Sd) UCL                                     | 56    |
| 531 |   |   |   |                                                                                                                              |        |   |   |                                         |   |                                                                 |       |
| 532 |   |   |   | <b>Suggested UCL to Use</b>                                                                                                  |        |   |   |                                         |   |                                                                 |       |
| 533 |   |   |   | 95% Adjusted Gamma UCL                                                                                                       | 25.06  |   |   |                                         |   |                                                                 |       |
| 534 |   |   |   |                                                                                                                              |        |   |   |                                         |   |                                                                 |       |
| 535 |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. |        |   |   |                                         |   |                                                                 |       |
| 536 |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                   |        |   |   |                                         |   |                                                                 |       |

| A   | B                                                                                                                                        | C      | D                                                               | E | F     | G | H | I | J | K | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------------------|---|-------|---|---|---|---|---|---|
| 537 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |                                                                 |   |       |   |   |   |   |   |   |
| 538 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |                                                                 |   |       |   |   |   |   |   |   |
| 539 |                                                                                                                                          |        |                                                                 |   |       |   |   |   |   |   |   |
| 540 |                                                                                                                                          |        |                                                                 |   |       |   |   |   |   |   |   |
| 541 | <b>Result (eu1_chromium_overbank)</b>                                                                                                    |        |                                                                 |   |       |   |   |   |   |   |   |
| 542 |                                                                                                                                          |        |                                                                 |   |       |   |   |   |   |   |   |
| 543 | <b>General Statistics</b>                                                                                                                |        |                                                                 |   |       |   |   |   |   |   |   |
| 544 | Total Number of Observations                                                                                                             | 29     | Number of Distinct Observations                                 |   | 23    |   |   |   |   |   |   |
| 545 |                                                                                                                                          |        | Number of Missing Observations                                  |   | 0     |   |   |   |   |   |   |
| 546 | Minimum                                                                                                                                  | 1.7    | Mean                                                            |   | 4.793 |   |   |   |   |   |   |
| 547 | Maximum                                                                                                                                  | 12     | Median                                                          |   | 4.7   |   |   |   |   |   |   |
| 548 | SD                                                                                                                                       | 1.988  | Std. Error of Mean                                              |   | 0.369 |   |   |   |   |   |   |
| 549 | Coefficient of Variation                                                                                                                 | 0.415  | Skewness                                                        |   | 1.508 |   |   |   |   |   |   |
| 550 |                                                                                                                                          |        |                                                                 |   |       |   |   |   |   |   |   |
| 551 | <b>Normal GOF Test</b>                                                                                                                   |        |                                                                 |   |       |   |   |   |   |   |   |
| 552 | Shapiro Wilk Test Statistic                                                                                                              | 0.888  | <b>Shapiro Wilk GOF Test</b>                                    |   |       |   |   |   |   |   |   |
| 553 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.926  | Data Not Normal at 5% Significance Level                        |   |       |   |   |   |   |   |   |
| 554 | Lilliefors Test Statistic                                                                                                                | 0.134  | <b>Lilliefors GOF Test</b>                                      |   |       |   |   |   |   |   |   |
| 555 | 5% Lilliefors Critical Value                                                                                                             | 0.161  | Data appear Normal at 5% Significance Level                     |   |       |   |   |   |   |   |   |
| 556 | <b>Data appear Approximate Normal at 5% Significance Level</b>                                                                           |        |                                                                 |   |       |   |   |   |   |   |   |
| 557 |                                                                                                                                          |        |                                                                 |   |       |   |   |   |   |   |   |
| 558 | <b>Assuming Normal Distribution</b>                                                                                                      |        |                                                                 |   |       |   |   |   |   |   |   |
| 559 | <b>95% Normal UCL</b>                                                                                                                    |        | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |       |   |   |   |   |   |   |
| 560 | 95% Student's-t UCL                                                                                                                      | 5.421  | 95% Adjusted-CLT UCL (Chen-1995)                                |   | 5.511 |   |   |   |   |   |   |
| 561 |                                                                                                                                          |        | 95% Modified-t UCL (Johnson-1978)                               |   | 5.438 |   |   |   |   |   |   |
| 562 |                                                                                                                                          |        |                                                                 |   |       |   |   |   |   |   |   |
| 563 | <b>Gamma GOF Test</b>                                                                                                                    |        |                                                                 |   |       |   |   |   |   |   |   |
| 564 | A-D Test Statistic                                                                                                                       | 0.38   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |       |   |   |   |   |   |   |
| 565 | 5% A-D Critical Value                                                                                                                    | 0.747  | detected data appear Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |   |   |
| 566 | K-S Test Statistic                                                                                                                       | 0.117  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |       |   |   |   |   |   |   |
| 567 | 5% K-S Critical Value                                                                                                                    | 0.163  | detected data appear Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |   |   |
| 568 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |        |                                                                 |   |       |   |   |   |   |   |   |
| 569 |                                                                                                                                          |        |                                                                 |   |       |   |   |   |   |   |   |
| 570 | <b>Gamma Statistics</b>                                                                                                                  |        |                                                                 |   |       |   |   |   |   |   |   |
| 571 | k hat (MLE)                                                                                                                              | 6.495  | k star (bias corrected MLE)                                     |   | 5.846 |   |   |   |   |   |   |
| 572 | Theta hat (MLE)                                                                                                                          | 0.738  | Theta star (bias corrected MLE)                                 |   | 0.82  |   |   |   |   |   |   |
| 573 | nu hat (MLE)                                                                                                                             | 376.7  | nu star (bias corrected)                                        |   | 339   |   |   |   |   |   |   |
| 574 | MLE Mean (bias corrected)                                                                                                                | 4.793  | MLE Sd (bias corrected)                                         |   | 1.982 |   |   |   |   |   |   |
| 575 |                                                                                                                                          |        | Approximate Chi Square Value (0.05)                             |   | 297.4 |   |   |   |   |   |   |
| 576 | Adjusted Level of Significance                                                                                                           | 0.0407 | Adjusted Chi Square Value                                       |   | 295.1 |   |   |   |   |   |   |
| 577 |                                                                                                                                          |        |                                                                 |   |       |   |   |   |   |   |   |
| 578 | <b>Assuming Gamma Distribution</b>                                                                                                       |        |                                                                 |   |       |   |   |   |   |   |   |
| 579 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | 5.465  | 95% Adjusted Gamma UCL (use when n<50)                          |   | 5.508 |   |   |   |   |   |   |
| 580 |                                                                                                                                          |        |                                                                 |   |       |   |   |   |   |   |   |
| 581 | <b>Lognormal GOF Test</b>                                                                                                                |        |                                                                 |   |       |   |   |   |   |   |   |
| 582 | Shapiro Wilk Test Statistic                                                                                                              | 0.963  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |       |   |   |   |   |   |   |
| 583 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.926  | Data appear Lognormal at 5% Significance Level                  |   |       |   |   |   |   |   |   |
| 584 | Lilliefors Test Statistic                                                                                                                | 0.122  | <b>Lilliefors Lognormal GOF Test</b>                            |   |       |   |   |   |   |   |   |
| 585 | 5% Lilliefors Critical Value                                                                                                             | 0.161  | Data appear Lognormal at 5% Significance Level                  |   |       |   |   |   |   |   |   |
| 586 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |        |                                                                 |   |       |   |   |   |   |   |   |
| 587 |                                                                                                                                          |        |                                                                 |   |       |   |   |   |   |   |   |
| 588 | <b>Lognormal Statistics</b>                                                                                                              |        |                                                                 |   |       |   |   |   |   |   |   |
| 589 | Minimum of Logged Data                                                                                                                   | 0.531  | Mean of logged Data                                             |   | 1.488 |   |   |   |   |   |   |
| 590 | Maximum of Logged Data                                                                                                                   | 2.485  | SD of logged Data                                               |   | 0.411 |   |   |   |   |   |   |
| 591 |                                                                                                                                          |        |                                                                 |   |       |   |   |   |   |   |   |
| 592 | <b>Assuming Lognormal Distribution</b>                                                                                                   |        |                                                                 |   |       |   |   |   |   |   |   |
| 593 | 95% H-UCL                                                                                                                                | 5.576  | 90% Chebyshev (MVUE) UCL                                        |   | 5.937 |   |   |   |   |   |   |
| 594 | 95% Chebyshev (MVUE) UCL                                                                                                                 | 6.45   | 97.5% Chebyshev (MVUE) UCL                                      |   | 7.162 |   |   |   |   |   |   |
| 595 | 99% Chebyshev (MVUE) UCL                                                                                                                 | 8.561  |                                                                 |   |       |   |   |   |   |   |   |
| 596 |                                                                                                                                          |        |                                                                 |   |       |   |   |   |   |   |   |
| 597 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |                                                                 |   |       |   |   |   |   |   |   |
| 598 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |        |                                                                 |   |       |   |   |   |   |   |   |
| 599 |                                                                                                                                          |        |                                                                 |   |       |   |   |   |   |   |   |
| 600 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |        |                                                                 |   |       |   |   |   |   |   |   |
| 601 | 95% CLT UCL                                                                                                                              | 5.4    | 95% Jackknife UCL                                               |   | 5.421 |   |   |   |   |   |   |
| 602 | 95% Standard Bootstrap UCL                                                                                                               | 5.394  | 95% Bootstrap-t UCL                                             |   | 5.536 |   |   |   |   |   |   |
| 603 | 95% Hall's Bootstrap UCL                                                                                                                 | 5.775  | 95% Percentile Bootstrap UCL                                    |   | 5.376 |   |   |   |   |   |   |

| A   | B                                                                                                                                        | C | D      | E                                                               | F | G | H | I     | J | K | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|-----------------------------------------------------------------|---|---|---|-------|---|---|---|
| 604 | 95% BCA Bootstrap UCL                                                                                                                    |   | 5.434  |                                                                 |   |   |   |       |   |   |   |
| 605 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 5.901  | 95% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 6.403 |   |   |   |
| 606 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 7.099  | 99% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 8.467 |   |   |   |
| 607 |                                                                                                                                          |   |        |                                                                 |   |   |   |       |   |   |   |
| 608 | <b>Suggested UCL to Use</b>                                                                                                              |   |        |                                                                 |   |   |   |       |   |   |   |
| 609 | 95% Student's-t UCL                                                                                                                      |   | 5.421  |                                                                 |   |   |   |       |   |   |   |
| 610 |                                                                                                                                          |   |        |                                                                 |   |   |   |       |   |   |   |
| 611 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                           |   |        |                                                                 |   |   |   |       |   |   |   |
| 612 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                   |   |        |                                                                 |   |   |   |       |   |   |   |
| 613 |                                                                                                                                          |   |        |                                                                 |   |   |   |       |   |   |   |
| 614 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |                                                                 |   |   |   |       |   |   |   |
| 615 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |                                                                 |   |   |   |       |   |   |   |
| 616 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |                                                                 |   |   |   |       |   |   |   |
| 617 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |                                                                 |   |   |   |       |   |   |   |
| 618 |                                                                                                                                          |   |        |                                                                 |   |   |   |       |   |   |   |
| 619 |                                                                                                                                          |   |        |                                                                 |   |   |   |       |   |   |   |
| 620 | <b>Result (eu1_chromium_waste rock)</b>                                                                                                  |   |        |                                                                 |   |   |   |       |   |   |   |
| 621 |                                                                                                                                          |   |        |                                                                 |   |   |   |       |   |   |   |
| 622 | <b>General Statistics</b>                                                                                                                |   |        |                                                                 |   |   |   |       |   |   |   |
| 623 | Total Number of Observations                                                                                                             |   | 29     | Number of Distinct Observations                                 |   |   |   | 21    |   |   |   |
| 624 |                                                                                                                                          |   |        | Number of Missing Observations                                  |   |   |   | 0     |   |   |   |
| 625 | Minimum                                                                                                                                  |   | 0.4    | Mean                                                            |   |   |   | 2.287 |   |   |   |
| 626 | Maximum                                                                                                                                  |   | 7.7    | Median                                                          |   |   |   | 1.6   |   |   |   |
| 627 | SD                                                                                                                                       |   | 1.852  | Std. Error of Mean                                              |   |   |   | 0.344 |   |   |   |
| 628 | Coefficient of Variation                                                                                                                 |   | 0.81   | Skewness                                                        |   |   |   | 1.446 |   |   |   |
| 629 |                                                                                                                                          |   |        |                                                                 |   |   |   |       |   |   |   |
| 630 | <b>Normal GOF Test</b>                                                                                                                   |   |        |                                                                 |   |   |   |       |   |   |   |
| 631 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.829  | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |       |   |   |   |
| 632 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.926  | Data Not Normal at 5% Significance Level                        |   |   |   |       |   |   |   |
| 633 | Lilliefors Test Statistic                                                                                                                |   | 0.211  | <b>Lilliefors GOF Test</b>                                      |   |   |   |       |   |   |   |
| 634 | 5% Lilliefors Critical Value                                                                                                             |   | 0.161  | Data Not Normal at 5% Significance Level                        |   |   |   |       |   |   |   |
| 635 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |        |                                                                 |   |   |   |       |   |   |   |
| 636 |                                                                                                                                          |   |        |                                                                 |   |   |   |       |   |   |   |
| 637 | <b>Assuming Normal Distribution</b>                                                                                                      |   |        |                                                                 |   |   |   |       |   |   |   |
| 638 | <b>95% Normal UCL</b>                                                                                                                    |   |        | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |   |       |   |   |   |
| 639 | 95% Student's-t UCL                                                                                                                      |   | 2.872  | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |   | 2.951 |   |   |   |
| 640 |                                                                                                                                          |   |        | 95% Modified-t UCL (Johnson-1978)                               |   |   |   | 2.888 |   |   |   |
| 641 |                                                                                                                                          |   |        |                                                                 |   |   |   |       |   |   |   |
| 642 | <b>Gamma GOF Test</b>                                                                                                                    |   |        |                                                                 |   |   |   |       |   |   |   |
| 643 | A-D Test Statistic                                                                                                                       |   | 0.549  | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |   |       |   |   |   |
| 644 | 5% A-D Critical Value                                                                                                                    |   | 0.758  | detected data appear Gamma Distributed at 5% Significance Level |   |   |   |       |   |   |   |
| 645 | K-S Test Statistic                                                                                                                       |   | 0.142  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |   |       |   |   |   |
| 646 | 5% K-S Critical Value                                                                                                                    |   | 0.165  | detected data appear Gamma Distributed at 5% Significance Level |   |   |   |       |   |   |   |
| 647 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |        |                                                                 |   |   |   |       |   |   |   |
| 648 |                                                                                                                                          |   |        |                                                                 |   |   |   |       |   |   |   |
| 649 | <b>Gamma Statistics</b>                                                                                                                  |   |        |                                                                 |   |   |   |       |   |   |   |
| 650 | k hat (MLE)                                                                                                                              |   | 1.894  | k star (bias corrected MLE)                                     |   |   |   | 1.721 |   |   |   |
| 651 | Theta hat (MLE)                                                                                                                          |   | 1.208  | Theta star (bias corrected MLE)                                 |   |   |   | 1.329 |   |   |   |
| 652 | nu hat (MLE)                                                                                                                             |   | 109.8  | nu star (bias corrected)                                        |   |   |   | 99.82 |   |   |   |
| 653 | MLE Mean (bias corrected)                                                                                                                |   | 2.287  | MLE Sd (bias corrected)                                         |   |   |   | 1.743 |   |   |   |
| 654 |                                                                                                                                          |   |        | Approximate Chi Square Value (0.05)                             |   |   |   | 77.77 |   |   |   |
| 655 | Adjusted Level of Significance                                                                                                           |   | 0.0407 | Adjusted Chi Square Value                                       |   |   |   | 76.61 |   |   |   |
| 656 |                                                                                                                                          |   |        |                                                                 |   |   |   |       |   |   |   |
| 657 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |        |                                                                 |   |   |   |       |   |   |   |
| 658 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   | 2.936  | 95% Adjusted Gamma UCL (use when n<50)                          |   |   |   | 2.98  |   |   |   |
| 659 |                                                                                                                                          |   |        |                                                                 |   |   |   |       |   |   |   |
| 660 | <b>Lognormal GOF Test</b>                                                                                                                |   |        |                                                                 |   |   |   |       |   |   |   |
| 661 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.975  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |   |       |   |   |   |
| 662 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.926  | Data appear Lognormal at 5% Significance Level                  |   |   |   |       |   |   |   |
| 663 | Lilliefors Test Statistic                                                                                                                |   | 0.0914 | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |   |       |   |   |   |
| 664 | 5% Lilliefors Critical Value                                                                                                             |   | 0.161  | Data appear Lognormal at 5% Significance Level                  |   |   |   |       |   |   |   |
| 665 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |        |                                                                 |   |   |   |       |   |   |   |
| 666 |                                                                                                                                          |   |        |                                                                 |   |   |   |       |   |   |   |
| 667 | <b>Lognormal Statistics</b>                                                                                                              |   |        |                                                                 |   |   |   |       |   |   |   |
| 668 | Minimum of Logged Data                                                                                                                   |   | -0.916 | Mean of logged Data                                             |   |   |   | 0.541 |   |   |   |
| 669 | Maximum of Logged Data                                                                                                                   |   | 2.041  | SD of logged Data                                               |   |   |   | 0.772 |   |   |   |
| 670 |                                                                                                                                          |   |        |                                                                 |   |   |   |       |   |   |   |

| A   | B                                                                                                                                        | C | D      | E | F                                                               | G | H | I | J     | K | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|---|-----------------------------------------------------------------|---|---|---|-------|---|---|
| 671 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |        |   |                                                                 |   |   |   |       |   |   |
| 672 | 95% H-UCL                                                                                                                                |   | 3.192  |   | 90% Chebyshev (MVUE) UCL                                        |   |   |   | 3.361 |   |   |
| 673 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 3.849  |   | 97.5% Chebyshev (MVUE) UCL                                      |   |   |   | 4.526 |   |   |
| 674 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 5.856  |   |                                                                 |   |   |   |       |   |   |
| 675 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 676 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |        |   |                                                                 |   |   |   |       |   |   |
| 677 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |        |   |                                                                 |   |   |   |       |   |   |
| 678 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 679 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |        |   |                                                                 |   |   |   |       |   |   |
| 680 | 95% CLT UCL                                                                                                                              |   | 2.853  |   | 95% Jackknife UCL                                               |   |   |   | 2.872 |   |   |
| 681 | 95% Standard Bootstrap UCL                                                                                                               |   | 2.852  |   | 95% Bootstrap-t UCL                                             |   |   |   | 3.03  |   |   |
| 682 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 2.963  |   | 95% Percentile Bootstrap UCL                                    |   |   |   | 2.902 |   |   |
| 683 | 95% BCA Bootstrap UCL                                                                                                                    |   | 2.975  |   |                                                                 |   |   |   |       |   |   |
| 684 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 3.319  |   | 95% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 3.786 |   |   |
| 685 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 4.435  |   | 99% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 5.708 |   |   |
| 686 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 687 | <b>Suggested UCL to Use</b>                                                                                                              |   |        |   |                                                                 |   |   |   |       |   |   |
| 688 | 95% Adjusted Gamma UCL                                                                                                                   |   | 2.98   |   |                                                                 |   |   |   |       |   |   |
| 689 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 690 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |   |                                                                 |   |   |   |       |   |   |
| 691 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |   |                                                                 |   |   |   |       |   |   |
| 692 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |   |                                                                 |   |   |   |       |   |   |
| 693 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |   |                                                                 |   |   |   |       |   |   |
| 694 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 695 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 696 | <b>Result (eu1_cobalt_overbank)</b>                                                                                                      |   |        |   |                                                                 |   |   |   |       |   |   |
| 697 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 698 | <b>General Statistics</b>                                                                                                                |   |        |   |                                                                 |   |   |   |       |   |   |
| 699 | Total Number of Observations                                                                                                             |   | 29     |   | Number of Distinct Observations                                 |   |   |   | 25    |   |   |
| 700 |                                                                                                                                          |   |        |   | Number of Missing Observations                                  |   |   |   | 0     |   |   |
| 701 | Minimum                                                                                                                                  |   | 2.5    |   | Mean                                                            |   |   |   | 13.37 |   |   |
| 702 | Maximum                                                                                                                                  |   | 63.6   |   | Median                                                          |   |   |   | 8.8   |   |   |
| 703 | SD                                                                                                                                       |   | 13.98  |   | Std. Error of Mean                                              |   |   |   | 2.597 |   |   |
| 704 | Coefficient of Variation                                                                                                                 |   | 1.046  |   | Skewness                                                        |   |   |   | 2.355 |   |   |
| 705 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 706 | <b>Normal GOF Test</b>                                                                                                                   |   |        |   |                                                                 |   |   |   |       |   |   |
| 707 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.703  |   | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |       |   |   |
| 708 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.926  |   | Data Not Normal at 5% Significance Level                        |   |   |   |       |   |   |
| 709 | Lilliefors Test Statistic                                                                                                                |   | 0.258  |   | <b>Lilliefors GOF Test</b>                                      |   |   |   |       |   |   |
| 710 | 5% Lilliefors Critical Value                                                                                                             |   | 0.161  |   | Data Not Normal at 5% Significance Level                        |   |   |   |       |   |   |
| 711 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 712 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 713 | <b>Assuming Normal Distribution</b>                                                                                                      |   |        |   |                                                                 |   |   |   |       |   |   |
| 714 | <b>95% Normal UCL</b>                                                                                                                    |   |        |   | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |   |       |   |   |
| 715 | 95% Student's-t UCL                                                                                                                      |   | 17.79  |   | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |   | 18.85 |   |   |
| 716 |                                                                                                                                          |   |        |   | 95% Modified-t UCL (Johnson-1978)                               |   |   |   | 17.98 |   |   |
| 717 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 718 | <b>Gamma GOF Test</b>                                                                                                                    |   |        |   |                                                                 |   |   |   |       |   |   |
| 719 | A-D Test Statistic                                                                                                                       |   | 0.973  |   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |   |       |   |   |
| 720 | 5% A-D Critical Value                                                                                                                    |   | 0.763  |   | Data Not Gamma Distributed at 5% Significance Level             |   |   |   |       |   |   |
| 721 | K-S Test Statistic                                                                                                                       |   | 0.15   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |   |       |   |   |
| 722 | 5% K-S Critical Value                                                                                                                    |   | 0.165  |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |       |   |   |
| 723 | <b>Detected data follow Appr. Gamma Distribution at 5% Significance Level</b>                                                            |   |        |   |                                                                 |   |   |   |       |   |   |
| 724 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 725 | <b>Gamma Statistics</b>                                                                                                                  |   |        |   |                                                                 |   |   |   |       |   |   |
| 726 | k hat (MLE)                                                                                                                              |   | 1.516  |   | k star (bias corrected MLE)                                     |   |   |   | 1.382 |   |   |
| 727 | Theta hat (MLE)                                                                                                                          |   | 8.817  |   | Theta star (bias corrected MLE)                                 |   |   |   | 9.671 |   |   |
| 728 | nu hat (MLE)                                                                                                                             |   | 87.94  |   | nu star (bias corrected)                                        |   |   |   | 80.18 |   |   |
| 729 | MLE Mean (bias corrected)                                                                                                                |   | 13.37  |   | MLE Sd (bias corrected)                                         |   |   |   | 11.37 |   |   |
| 730 |                                                                                                                                          |   |        |   | Approximate Chi Square Value (0.05)                             |   |   |   | 60.55 |   |   |
| 731 | Adjusted Level of Significance                                                                                                           |   | 0.0407 |   | Adjusted Chi Square Value                                       |   |   |   | 59.53 |   |   |
| 732 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 733 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |        |   |                                                                 |   |   |   |       |   |   |
| 734 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   | 17.7   |   | 95% Adjusted Gamma UCL (use when n<50)                          |   |   |   | 18.01 |   |   |
| 735 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 736 | <b>Lognormal GOF Test</b>                                                                                                                |   |        |   |                                                                 |   |   |   |       |   |   |
| 737 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.962  |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |   |       |   |   |

| A   | B                                                                                                                                        | C | D | E      | F                                                   | G | H | I     | J | K | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------|---|---|-------|---|---|---|
| 738 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.926  | Data appear Lognormal at 5% Significance Level      |   |   |       |   |   |   |
| 739 | Lilliefors Test Statistic                                                                                                                |   |   | 0.0867 | <b>Lilliefors Lognormal GOF Test</b>                |   |   |       |   |   |   |
| 740 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.161  | Data appear Lognormal at 5% Significance Level      |   |   |       |   |   |   |
| 741 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |        |                                                     |   |   |       |   |   |   |
| 742 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 743 | <b>Lognormal Statistics</b>                                                                                                              |   |   |        |                                                     |   |   |       |   |   |   |
| 744 | Minimum of Logged Data                                                                                                                   |   |   | 0.916  | Mean of logged Data                                 |   |   | 2.228 |   |   |   |
| 745 | Maximum of Logged Data                                                                                                                   |   |   | 4.153  | SD of logged Data                                   |   |   | 0.824 |   |   |   |
| 746 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 747 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |        |                                                     |   |   |       |   |   |   |
| 748 | 95% H-UCL                                                                                                                                |   |   | 18.54  | 90% Chebyshev (MVUE) UCL                            |   |   | 19.37 |   |   |   |
| 749 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 22.33  | 97.5% Chebyshev (MVUE) UCL                          |   |   | 26.43 |   |   |   |
| 750 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 34.49  |                                                     |   |   |       |   |   |   |
| 751 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 752 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |                                                     |   |   |       |   |   |   |
| 753 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |        |                                                     |   |   |       |   |   |   |
| 754 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 755 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |        |                                                     |   |   |       |   |   |   |
| 756 | 95% CLT UCL                                                                                                                              |   |   | 17.64  | 95% Jackknife UCL                                   |   |   | 17.79 |   |   |   |
| 757 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 17.54  | 95% Bootstrap-t UCL                                 |   |   | 20.24 |   |   |   |
| 758 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 20.5   | 95% Percentile Bootstrap UCL                        |   |   | 17.78 |   |   |   |
| 759 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 19.1   |                                                     |   |   |       |   |   |   |
| 760 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 21.16  | 95% Chebyshev(Mean, Sd) UCL                         |   |   | 24.69 |   |   |   |
| 761 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 29.59  | 99% Chebyshev(Mean, Sd) UCL                         |   |   | 39.21 |   |   |   |
| 762 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 763 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                     |   |   |       |   |   |   |
| 764 | 95% Adjusted Gamma UCL                                                                                                                   |   |   | 18.01  |                                                     |   |   |       |   |   |   |
| 765 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 766 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                           |   |   |        |                                                     |   |   |       |   |   |   |
| 767 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                   |   |   |        |                                                     |   |   |       |   |   |   |
| 768 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 769 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                     |   |   |       |   |   |   |
| 770 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                     |   |   |       |   |   |   |
| 771 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                     |   |   |       |   |   |   |
| 772 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                     |   |   |       |   |   |   |
| 773 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 774 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 775 | <b>Result (eu1_cobalt_waste rock)</b>                                                                                                    |   |   |        |                                                     |   |   |       |   |   |   |
| 776 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 777 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                     |   |   |       |   |   |   |
| 778 | Total Number of Observations                                                                                                             |   |   | 29     | Number of Distinct Observations                     |   |   | 28    |   |   |   |
| 779 |                                                                                                                                          |   |   |        | Number of Missing Observations                      |   |   | 0     |   |   |   |
| 780 | Minimum                                                                                                                                  |   |   | 0.26   | Mean                                                |   |   | 4.731 |   |   |   |
| 781 | Maximum                                                                                                                                  |   |   | 34.9   | Median                                              |   |   | 1.7   |   |   |   |
| 782 | SD                                                                                                                                       |   |   | 7.789  | Std. Error of Mean                                  |   |   | 1.446 |   |   |   |
| 783 | Coefficient of Variation                                                                                                                 |   |   | 1.646  | Skewness                                            |   |   | 2.755 |   |   |   |
| 784 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 785 | <b>Normal GOF Test</b>                                                                                                                   |   |   |        |                                                     |   |   |       |   |   |   |
| 786 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.612  | <b>Shapiro Wilk GOF Test</b>                        |   |   |       |   |   |   |
| 787 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.926  | Data Not Normal at 5% Significance Level            |   |   |       |   |   |   |
| 788 | Lilliefors Test Statistic                                                                                                                |   |   | 0.283  | <b>Lilliefors GOF Test</b>                          |   |   |       |   |   |   |
| 789 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.161  | Data Not Normal at 5% Significance Level            |   |   |       |   |   |   |
| 790 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 791 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 792 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |        |                                                     |   |   |       |   |   |   |
| 793 | <b>95% Normal UCL</b>                                                                                                                    |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>             |   |   |       |   |   |   |
| 794 | 95% Student's-t UCL                                                                                                                      |   |   | 7.191  | 95% Adjusted-CLT UCL (Chen-1995)                    |   |   | 7.9   |   |   |   |
| 795 |                                                                                                                                          |   |   |        | 95% Modified-t UCL (Johnson-1978)                   |   |   | 7.314 |   |   |   |
| 796 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 797 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |        |                                                     |   |   |       |   |   |   |
| 798 | A-D Test Statistic                                                                                                                       |   |   | 1.168  | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |       |   |   |   |
| 799 | 5% A-D Critical Value                                                                                                                    |   |   | 0.797  | Data Not Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |
| 800 | K-S Test Statistic                                                                                                                       |   |   | 0.182  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |       |   |   |   |
| 801 | 5% K-S Critical Value                                                                                                                    |   |   | 0.171  | Data Not Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |
| 802 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |   |        |                                                     |   |   |       |   |   |   |
| 803 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |
| 804 | <b>Gamma Statistics</b>                                                                                                                  |   |   |        |                                                     |   |   |       |   |   |   |

| A   | B | C | D | E                                                                                                                                        | F      | G | H | I | J                                              | K | L     |
|-----|---|---|---|------------------------------------------------------------------------------------------------------------------------------------------|--------|---|---|---|------------------------------------------------|---|-------|
| 805 |   |   |   | k hat (MLE)                                                                                                                              | 0.627  |   |   |   | k star (bias corrected MLE)                    |   | 0.585 |
| 806 |   |   |   | Theta hat (MLE)                                                                                                                          | 7.546  |   |   |   | Theta star (bias corrected MLE)                |   | 8.086 |
| 807 |   |   |   | nu hat (MLE)                                                                                                                             | 36.36  |   |   |   | nu star (bias corrected)                       |   | 33.93 |
| 808 |   |   |   | MLE Mean (bias corrected)                                                                                                                | 4.731  |   |   |   | MLE Sd (bias corrected)                        |   | 6.185 |
| 809 |   |   |   |                                                                                                                                          |        |   |   |   | Approximate Chi Square Value (0.05)            |   | 21.61 |
| 810 |   |   |   | Adjusted Level of Significance                                                                                                           | 0.0407 |   |   |   | Adjusted Chi Square Value                      |   | 21.02 |
| 811 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |       |
| 812 |   |   |   | <b>Assuming Gamma Distribution</b>                                                                                                       |        |   |   |   |                                                |   |       |
| 813 |   |   |   | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | 7.428  |   |   |   | 95% Adjusted Gamma UCL (use when n<50)         |   | 7.636 |
| 814 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |       |
| 815 |   |   |   | <b>Lognormal GOF Test</b>                                                                                                                |        |   |   |   |                                                |   |       |
| 816 |   |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.944  |   |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>         |   |       |
| 817 |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                           | 0.926  |   |   |   | Data appear Lognormal at 5% Significance Level |   |       |
| 818 |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.116  |   |   |   | <b>Lilliefors Lognormal GOF Test</b>           |   |       |
| 819 |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.161  |   |   |   | Data appear Lognormal at 5% Significance Level |   |       |
| 820 |   |   |   | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |        |   |   |   |                                                |   |       |
| 821 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |       |
| 822 |   |   |   | <b>Lognormal Statistics</b>                                                                                                              |        |   |   |   |                                                |   |       |
| 823 |   |   |   | Minimum of Logged Data                                                                                                                   | -1.347 |   |   |   | Mean of logged Data                            |   | 0.575 |
| 824 |   |   |   | Maximum of Logged Data                                                                                                                   | 3.552  |   |   |   | SD of logged Data                              |   | 1.413 |
| 825 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |       |
| 826 |   |   |   | <b>Assuming Lognormal Distribution</b>                                                                                                   |        |   |   |   |                                                |   |       |
| 827 |   |   |   | 95% H-UCL                                                                                                                                | 10.8   |   |   |   | 90% Chebyshev (MVUE) UCL                       |   | 8.939 |
| 828 |   |   |   | 95% Chebyshev (MVUE) UCL                                                                                                                 | 10.94  |   |   |   | 97.5% Chebyshev (MVUE) UCL                     |   | 13.71 |
| 829 |   |   |   | 99% Chebyshev (MVUE) UCL                                                                                                                 | 19.16  |   |   |   |                                                |   |       |
| 830 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |       |
| 831 |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |   |   |   |                                                |   |       |
| 832 |   |   |   | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |        |   |   |   |                                                |   |       |
| 833 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |       |
| 834 |   |   |   | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |        |   |   |   |                                                |   |       |
| 835 |   |   |   | 95% CLT UCL                                                                                                                              | 7.11   |   |   |   | 95% Jackknife UCL                              |   | 7.191 |
| 836 |   |   |   | 95% Standard Bootstrap UCL                                                                                                               | 7.081  |   |   |   | 95% Bootstrap-t UCL                            |   | 9.689 |
| 837 |   |   |   | 95% Hall's Bootstrap UCL                                                                                                                 | 8.447  |   |   |   | 95% Percentile Bootstrap UCL                   |   | 7.288 |
| 838 |   |   |   | 95% BCA Bootstrap UCL                                                                                                                    | 7.989  |   |   |   |                                                |   |       |
| 839 |   |   |   | 90% Chebyshev(Mean, Sd) UCL                                                                                                              | 9.07   |   |   |   | 95% Chebyshev(Mean, Sd) UCL                    |   | 11.03 |
| 840 |   |   |   | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            | 13.76  |   |   |   | 99% Chebyshev(Mean, Sd) UCL                    |   | 19.12 |
| 841 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |       |
| 842 |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |        |   |   |   |                                                |   |       |
| 843 |   |   |   | 95% H-UCL                                                                                                                                | 10.8   |   |   |   |                                                |   |       |
| 844 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |       |
| 845 |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |   |   |   |                                                |   |       |
| 846 |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |   |   |   |                                                |   |       |
| 847 |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |   |   |   |                                                |   |       |
| 848 |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |   |   |   |                                                |   |       |
| 849 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |       |
| 850 |   |   |   | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |        |   |   |   |                                                |   |       |
| 851 |   |   |   | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |        |   |   |   |                                                |   |       |
| 852 |   |   |   | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |        |   |   |   |                                                |   |       |
| 853 |   |   |   | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |        |   |   |   |                                                |   |       |
| 854 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |       |
| 855 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |       |
| 856 |   |   |   | <b>Result (eu1_iron_overbank)</b>                                                                                                        |        |   |   |   |                                                |   |       |
| 857 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |       |
| 858 |   |   |   | <b>General Statistics</b>                                                                                                                |        |   |   |   |                                                |   |       |
| 859 |   |   |   | Total Number of Observations                                                                                                             | 29     |   |   |   | Number of Distinct Observations                |   | 29    |
| 860 |   |   |   |                                                                                                                                          |        |   |   |   | Number of Missing Observations                 |   | 0     |
| 861 |   |   |   | Minimum                                                                                                                                  | 13000  |   |   |   | Mean                                           |   | 30955 |
| 862 |   |   |   | Maximum                                                                                                                                  | 106000 |   |   |   | Median                                         |   | 26000 |
| 863 |   |   |   | SD                                                                                                                                       | 18167  |   |   |   | Std. Error of Mean                             |   | 3373  |
| 864 |   |   |   | Coefficient of Variation                                                                                                                 | 0.587  |   |   |   | Skewness                                       |   | 2.95  |
| 865 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |       |
| 866 |   |   |   | <b>Normal GOF Test</b>                                                                                                                   |        |   |   |   |                                                |   |       |
| 867 |   |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.691  |   |   |   | <b>Shapiro Wilk GOF Test</b>                   |   |       |
| 868 |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                           | 0.926  |   |   |   | Data Not Normal at 5% Significance Level       |   |       |
| 869 |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.218  |   |   |   | <b>Lilliefors GOF Test</b>                     |   |       |
| 870 |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.161  |   |   |   | Data Not Normal at 5% Significance Level       |   |       |
| 871 |   |   |   | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |        |   |   |   |                                                |   |       |

|     | A                                                                                                                                       | B | C | D      | E | F | G                                                   | H | I | J     | K | L |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|---|---|-----------------------------------------------------|---|---|-------|---|---|
| 872 |                                                                                                                                         |   |   |        |   |   |                                                     |   |   |       |   |   |
| 873 | <b>Assuming Normal Distribution</b>                                                                                                     |   |   |        |   |   |                                                     |   |   |       |   |   |
| 874 | <b>95% Normal UCL</b>                                                                                                                   |   |   |        |   |   | <b>95% UCLs (Adjusted for Skewness)</b>             |   |   |       |   |   |
| 875 | 95% Student's-t UCL                                                                                                                     |   |   | 36694  |   |   | 95% Adjusted-CLT UCL (Chen-1995)                    |   |   | 38478 |   |   |
| 876 |                                                                                                                                         |   |   |        |   |   | 95% Modified-t UCL (Johnson-1978)                   |   |   | 37002 |   |   |
| 877 |                                                                                                                                         |   |   |        |   |   |                                                     |   |   |       |   |   |
| 878 | <b>Gamma GOF Test</b>                                                                                                                   |   |   |        |   |   |                                                     |   |   |       |   |   |
| 879 | A-D Test Statistic                                                                                                                      |   |   | 1.087  |   |   | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |       |   |   |
| 880 | 5% A-D Critical Value                                                                                                                   |   |   | 0.748  |   |   | Data Not Gamma Distributed at 5% Significance Level |   |   |       |   |   |
| 881 | K-S Test Statistic                                                                                                                      |   |   | 0.165  |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |       |   |   |
| 882 | 5% K-S Critical Value                                                                                                                   |   |   | 0.163  |   |   | Data Not Gamma Distributed at 5% Significance Level |   |   |       |   |   |
| 883 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                              |   |   |        |   |   |                                                     |   |   |       |   |   |
| 884 |                                                                                                                                         |   |   |        |   |   |                                                     |   |   |       |   |   |
| 885 | <b>Gamma Statistics</b>                                                                                                                 |   |   |        |   |   |                                                     |   |   |       |   |   |
| 886 | k hat (MLE)                                                                                                                             |   |   | 4.808  |   |   | k star (bias corrected MLE)                         |   |   | 4.333 |   |   |
| 887 | Theta hat (MLE)                                                                                                                         |   |   | 6439   |   |   | Theta star (bias corrected MLE)                     |   |   | 7144  |   |   |
| 888 | nu hat (MLE)                                                                                                                            |   |   | 278.8  |   |   | nu star (bias corrected)                            |   |   | 251.3 |   |   |
| 889 | MLE Mean (bias corrected)                                                                                                               |   |   | 30955  |   |   | MLE Sd (bias corrected)                             |   |   | 14871 |   |   |
| 890 |                                                                                                                                         |   |   |        |   |   | Approximate Chi Square Value (0.05)                 |   |   | 215.6 |   |   |
| 891 | Adjusted Level of Significance                                                                                                          |   |   | 0.0407 |   |   | Adjusted Chi Square Value                           |   |   | 213.6 |   |   |
| 892 |                                                                                                                                         |   |   |        |   |   |                                                     |   |   |       |   |   |
| 893 | <b>Assuming Gamma Distribution</b>                                                                                                      |   |   |        |   |   |                                                     |   |   |       |   |   |
| 894 | 95% Approximate Gamma UCL (use when n>=50))                                                                                             |   |   | 36081  |   |   | 95% Adjusted Gamma UCL (use when n<50)              |   |   | 36414 |   |   |
| 895 |                                                                                                                                         |   |   |        |   |   |                                                     |   |   |       |   |   |
| 896 | <b>Lognormal GOF Test</b>                                                                                                               |   |   |        |   |   |                                                     |   |   |       |   |   |
| 897 | Shapiro Wilk Test Statistic                                                                                                             |   |   | 0.931  |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |   |       |   |   |
| 898 | 5% Shapiro Wilk Critical Value                                                                                                          |   |   | 0.926  |   |   | Data appear Lognormal at 5% Significance Level      |   |   |       |   |   |
| 899 | Lilliefors Test Statistic                                                                                                               |   |   | 0.13   |   |   | <b>Lilliefors Lognormal GOF Test</b>                |   |   |       |   |   |
| 900 | 5% Lilliefors Critical Value                                                                                                            |   |   | 0.161  |   |   | Data appear Lognormal at 5% Significance Level      |   |   |       |   |   |
| 901 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                   |   |   |        |   |   |                                                     |   |   |       |   |   |
| 902 |                                                                                                                                         |   |   |        |   |   |                                                     |   |   |       |   |   |
| 903 | <b>Lognormal Statistics</b>                                                                                                             |   |   |        |   |   |                                                     |   |   |       |   |   |
| 904 | Minimum of Logged Data                                                                                                                  |   |   | 9.473  |   |   | Mean of logged Data                                 |   |   | 10.23 |   |   |
| 905 | Maximum of Logged Data                                                                                                                  |   |   | 11.57  |   |   | SD of logged Data                                   |   |   | 0.438 |   |   |
| 906 |                                                                                                                                         |   |   |        |   |   |                                                     |   |   |       |   |   |
| 907 | <b>Assuming Lognormal Distribution</b>                                                                                                  |   |   |        |   |   |                                                     |   |   |       |   |   |
| 908 | 95% H-UCL                                                                                                                               |   |   | 35789  |   |   | 90% Chebyshev (MVUE) UCL                            |   |   | 38162 |   |   |
| 909 | 95% Chebyshev (MVUE) UCL                                                                                                                |   |   | 41641  |   |   | 97.5% Chebyshev (MVUE) UCL                          |   |   | 46470 |   |   |
| 910 | 99% Chebyshev (MVUE) UCL                                                                                                                |   |   | 55956  |   |   |                                                     |   |   |       |   |   |
| 911 |                                                                                                                                         |   |   |        |   |   |                                                     |   |   |       |   |   |
| 912 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                   |   |   |        |   |   |                                                     |   |   |       |   |   |
| 913 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                        |   |   |        |   |   |                                                     |   |   |       |   |   |
| 914 |                                                                                                                                         |   |   |        |   |   |                                                     |   |   |       |   |   |
| 915 | <b>Nonparametric Distribution Free UCLs</b>                                                                                             |   |   |        |   |   |                                                     |   |   |       |   |   |
| 916 | 95% CLT UCL                                                                                                                             |   |   | 36504  |   |   | 95% Jackknife UCL                                   |   |   | 36694 |   |   |
| 917 | 95% Standard Bootstrap UCL                                                                                                              |   |   | 36413  |   |   | 95% Bootstrap-t UCL                                 |   |   | 41817 |   |   |
| 918 | 95% Hall's Bootstrap UCL                                                                                                                |   |   | 65218  |   |   | 95% Percentile Bootstrap UCL                        |   |   | 36759 |   |   |
| 919 | 95% BCA Bootstrap UCL                                                                                                                   |   |   | 39017  |   |   |                                                     |   |   |       |   |   |
| 920 | 90% Chebyshev(Mean, Sd) UCL                                                                                                             |   |   | 41076  |   |   | 95% Chebyshev(Mean, Sd) UCL                         |   |   | 45660 |   |   |
| 921 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                           |   |   | 52022  |   |   | 99% Chebyshev(Mean, Sd) UCL                         |   |   | 64521 |   |   |
| 922 |                                                                                                                                         |   |   |        |   |   |                                                     |   |   |       |   |   |
| 923 | <b>Suggested UCL to Use</b>                                                                                                             |   |   |        |   |   |                                                     |   |   |       |   |   |
| 924 | 95% Student's-t UCL                                                                                                                     |   |   | 36694  |   |   | or 95% Modified-t UCL                               |   |   | 37002 |   |   |
| 925 | or 95% H-UCL                                                                                                                            |   |   | 35789  |   |   |                                                     |   |   |       |   |   |
| 926 |                                                                                                                                         |   |   |        |   |   |                                                     |   |   |       |   |   |
| 927 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.            |   |   |        |   |   |                                                     |   |   |       |   |   |
| 928 | Recommendations are based upon data size, data distribution, and skewness.                                                              |   |   |        |   |   |                                                     |   |   |       |   |   |
| 929 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                |   |   |        |   |   |                                                     |   |   |       |   |   |
| 930 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statisticia |   |   |        |   |   |                                                     |   |   |       |   |   |
| 931 |                                                                                                                                         |   |   |        |   |   |                                                     |   |   |       |   |   |
| 932 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                  |   |   |        |   |   |                                                     |   |   |       |   |   |
| 933 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>           |   |   |        |   |   |                                                     |   |   |       |   |   |
| 934 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                      |   |   |        |   |   |                                                     |   |   |       |   |   |
| 935 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>       |   |   |        |   |   |                                                     |   |   |       |   |   |
| 936 |                                                                                                                                         |   |   |        |   |   |                                                     |   |   |       |   |   |
| 937 |                                                                                                                                         |   |   |        |   |   |                                                     |   |   |       |   |   |
| 938 | <b>Result (eu1_iron_waste rock)</b>                                                                                                     |   |   |        |   |   |                                                     |   |   |       |   |   |

|      | A                                                                                | B | C | D      | E | F                                                               | G                                       | H | I     | J     | K | L |
|------|----------------------------------------------------------------------------------|---|---|--------|---|-----------------------------------------------------------------|-----------------------------------------|---|-------|-------|---|---|
| 939  |                                                                                  |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 940  | <b>General Statistics</b>                                                        |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 941  | Total Number of Observations                                                     |   |   | 29     |   | Number of Distinct Observations                                 |                                         |   | 28    |       |   |   |
| 942  |                                                                                  |   |   |        |   |                                                                 | Number of Missing Observations          |   |       | 0     |   |   |
| 943  | Minimum                                                                          |   |   | 14600  |   | Mean                                                            |                                         |   | 35807 |       |   |   |
| 944  | Maximum                                                                          |   |   | 102000 |   | Median                                                          |                                         |   | 33300 |       |   |   |
| 945  | SD                                                                               |   |   | 16771  |   | Std. Error of Mean                                              |                                         |   | 3114  |       |   |   |
| 946  | Coefficient of Variation                                                         |   |   | 0.468  |   | Skewness                                                        |                                         |   | 2.263 |       |   |   |
| 947  |                                                                                  |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 948  | <b>Normal GOF Test</b>                                                           |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 949  | Shapiro Wilk Test Statistic                                                      |   |   | 0.816  |   | <b>Shapiro Wilk GOF Test</b>                                    |                                         |   |       |       |   |   |
| 950  | 5% Shapiro Wilk Critical Value                                                   |   |   | 0.926  |   | Data Not Normal at 5% Significance Level                        |                                         |   |       |       |   |   |
| 951  | Lilliefors Test Statistic                                                        |   |   | 0.158  |   | <b>Lilliefors GOF Test</b>                                      |                                         |   |       |       |   |   |
| 952  | 5% Lilliefors Critical Value                                                     |   |   | 0.161  |   | Data appear Normal at 5% Significance Level                     |                                         |   |       |       |   |   |
| 953  | <b>Data appear Approximate Normal at 5% Significance Level</b>                   |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 954  |                                                                                  |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 955  | <b>Assuming Normal Distribution</b>                                              |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 956  | <b>95% Normal UCL</b>                                                            |   |   |        |   |                                                                 | <b>95% UCLs (Adjusted for Skewness)</b> |   |       |       |   |   |
| 957  | 95% Student's-t UCL                                                              |   |   | 41105  |   | 95% Adjusted-CLT UCL (Chen-1995)                                |                                         |   | 42328 |       |   |   |
| 958  |                                                                                  |   |   |        |   |                                                                 | 95% Modified-t UCL (Johnson-1978)       |   |       | 41323 |   |   |
| 959  |                                                                                  |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 960  | <b>Gamma GOF Test</b>                                                            |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 961  | A-D Test Statistic                                                               |   |   | 0.394  |   | <b>Anderson-Darling Gamma GOF Test</b>                          |                                         |   |       |       |   |   |
| 962  | 5% A-D Critical Value                                                            |   |   | 0.747  |   | Detected data appear Gamma Distributed at 5% Significance Level |                                         |   |       |       |   |   |
| 963  | K-S Test Statistic                                                               |   |   | 0.0977 |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |                                         |   |       |       |   |   |
| 964  | 5% K-S Critical Value                                                            |   |   | 0.163  |   | Detected data appear Gamma Distributed at 5% Significance Level |                                         |   |       |       |   |   |
| 965  | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>           |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 966  |                                                                                  |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 967  | <b>Gamma Statistics</b>                                                          |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 968  | k hat (MLE)                                                                      |   |   | 6.077  |   | k star (bias corrected MLE)                                     |                                         |   | 5.471 |       |   |   |
| 969  | Theta hat (MLE)                                                                  |   |   | 5892   |   | Theta star (bias corrected MLE)                                 |                                         |   | 6545  |       |   |   |
| 970  | nu hat (MLE)                                                                     |   |   | 352.5  |   | nu star (bias corrected)                                        |                                         |   | 317.3 |       |   |   |
| 971  | MLE Mean (bias corrected)                                                        |   |   | 35807  |   | MLE Sd (bias corrected)                                         |                                         |   | 15308 |       |   |   |
| 972  |                                                                                  |   |   |        |   |                                                                 | Approximate Chi Square Value (0.05)     |   |       | 277.1 |   |   |
| 973  | Adjusted Level of Significance                                                   |   |   | 0.0407 |   | Adjusted Chi Square Value                                       |                                         |   | 274.8 |       |   |   |
| 974  |                                                                                  |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 975  | <b>Assuming Gamma Distribution</b>                                               |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 976  | 95% Approximate Gamma UCL (use when n>=50))                                      |   |   | 41011  |   | 95% Adjusted Gamma UCL (use when n<50)                          |                                         |   | 41346 |       |   |   |
| 977  |                                                                                  |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 978  | <b>Lognormal GOF Test</b>                                                        |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 979  | Shapiro Wilk Test Statistic                                                      |   |   | 0.973  |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |                                         |   |       |       |   |   |
| 980  | 5% Shapiro Wilk Critical Value                                                   |   |   | 0.926  |   | Data appear Lognormal at 5% Significance Level                  |                                         |   |       |       |   |   |
| 981  | Lilliefors Test Statistic                                                        |   |   | 0.0781 |   | <b>Lilliefors Lognormal GOF Test</b>                            |                                         |   |       |       |   |   |
| 982  | 5% Lilliefors Critical Value                                                     |   |   | 0.161  |   | Data appear Lognormal at 5% Significance Level                  |                                         |   |       |       |   |   |
| 983  | <b>Data appear Lognormal at 5% Significance Level</b>                            |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 984  |                                                                                  |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 985  | <b>Lognormal Statistics</b>                                                      |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 986  | Minimum of Logged Data                                                           |   |   | 9.589  |   | Mean of logged Data                                             |                                         |   | 10.4  |       |   |   |
| 987  | Maximum of Logged Data                                                           |   |   | 11.53  |   | SD of logged Data                                               |                                         |   | 0.408 |       |   |   |
| 988  |                                                                                  |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 989  | <b>Assuming Lognormal Distribution</b>                                           |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 990  | 95% H-UCL                                                                        |   |   | 41324  |   | 90% Chebyshev (MVUE) UCL                                        |                                         |   | 43989 |       |   |   |
| 991  | 95% Chebyshev (MVUE) UCL                                                         |   |   | 47767  |   | 97.5% Chebyshev (MVUE) UCL                                      |                                         |   | 53011 |       |   |   |
| 992  | 99% Chebyshev (MVUE) UCL                                                         |   |   | 63311  |   |                                                                 |                                         |   |       |       |   |   |
| 993  |                                                                                  |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 994  | <b>Nonparametric Distribution Free UCL Statistics</b>                            |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 995  | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b> |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 996  |                                                                                  |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 997  | <b>Nonparametric Distribution Free UCLs</b>                                      |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 998  | 95% CLT UCL                                                                      |   |   | 40929  |   | 95% Jackknife UCL                                               |                                         |   | 41105 |       |   |   |
| 999  | 95% Standard Bootstrap UCL                                                       |   |   | 40852  |   | 95% Bootstrap-t UCL                                             |                                         |   | 43321 |       |   |   |
| 1000 | 95% Hall's Bootstrap UCL                                                         |   |   | 49217  |   | 95% Percentile Bootstrap UCL                                    |                                         |   | 41162 |       |   |   |
| 1001 | 95% BCA Bootstrap UCL                                                            |   |   | 41879  |   |                                                                 |                                         |   |       |       |   |   |
| 1002 | 90% Chebyshev(Mean, Sd) UCL                                                      |   |   | 45150  |   | 95% Chebyshev(Mean, Sd) UCL                                     |                                         |   | 49382 |       |   |   |
| 1003 | 97.5% Chebyshev(Mean, Sd) UCL                                                    |   |   | 55255  |   | 99% Chebyshev(Mean, Sd) UCL                                     |                                         |   | 66793 |       |   |   |
| 1004 |                                                                                  |   |   |        |   |                                                                 |                                         |   |       |       |   |   |
| 1005 | <b>Suggested UCL to Use</b>                                                      |   |   |        |   |                                                                 |                                         |   |       |       |   |   |

| A    | B                                                                                                                                        | C | D | E      | F                                                               | G | H | I     | J | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------------------|---|---|-------|---|---|---|--|
| 1006 | 95% Student's-t UCL                                                                                                                      |   |   | 41105  |                                                                 |   |   |       |   |   |   |  |
| 1007 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1008 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                           |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1009 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                   |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1010 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1011 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1012 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1013 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1014 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1015 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1016 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1017 | <b>Result (eu1_manganese_overbank)</b>                                                                                                   |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1018 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1019 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1020 | Total Number of Observations                                                                                                             |   |   | 29     | Number of Distinct Observations                                 |   |   | 29    |   |   |   |  |
| 1021 |                                                                                                                                          |   |   |        | Number of Missing Observations                                  |   |   | 0     |   |   |   |  |
| 1022 | Minimum                                                                                                                                  |   |   | 347    | Mean                                                            |   |   | 7181  |   |   |   |  |
| 1023 | Maximum                                                                                                                                  |   |   | 55900  | Median                                                          |   |   | 4270  |   |   |   |  |
| 1024 | SD                                                                                                                                       |   |   | 10699  | Std. Error of Mean                                              |   |   | 1987  |   |   |   |  |
| 1025 | Coefficient of Variation                                                                                                                 |   |   | 1.49   | Skewness                                                        |   |   | 3.635 |   |   |   |  |
| 1026 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1027 | <b>Normal GOF Test</b>                                                                                                                   |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1028 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.594  | <b>Shapiro Wilk GOF Test</b>                                    |   |   |       |   |   |   |  |
| 1029 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.926  | Data Not Normal at 5% Significance Level                        |   |   |       |   |   |   |  |
| 1030 | Lilliefors Test Statistic                                                                                                                |   |   | 0.261  | <b>Lilliefors GOF Test</b>                                      |   |   |       |   |   |   |  |
| 1031 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.161  | Data Not Normal at 5% Significance Level                        |   |   |       |   |   |   |  |
| 1032 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1033 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1034 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1035 | <b>95% Normal UCL</b>                                                                                                                    |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |       |   |   |   |  |
| 1036 | 95% Student's-t UCL                                                                                                                      |   |   | 10561  | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   | 11882 |   |   |   |  |
| 1037 |                                                                                                                                          |   |   |        | 95% Modified-t UCL (Johnson-1978)                               |   |   | 10784 |   |   |   |  |
| 1038 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1039 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1040 | A-D Test Statistic                                                                                                                       |   |   | 0.43   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |       |   |   |   |  |
| 1041 | 5% A-D Critical Value                                                                                                                    |   |   | 0.781  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |  |
| 1042 | K-S Test Statistic                                                                                                                       |   |   | 0.126  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |       |   |   |   |  |
| 1043 | 5% K-S Critical Value                                                                                                                    |   |   | 0.169  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |  |
| 1044 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1045 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1046 | <b>Gamma Statistics</b>                                                                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1047 | k hat (MLE)                                                                                                                              |   |   | 0.817  | k star (bias corrected MLE)                                     |   |   | 0.756 |   |   |   |  |
| 1048 | Theta hat (MLE)                                                                                                                          |   |   | 8787   | Theta star (bias corrected MLE)                                 |   |   | 9503  |   |   |   |  |
| 1049 | nu hat (MLE)                                                                                                                             |   |   | 47.4   | nu star (bias corrected)                                        |   |   | 43.83 |   |   |   |  |
| 1050 | MLE Mean (bias corrected)                                                                                                                |   |   | 7181   | MLE Sd (bias corrected)                                         |   |   | 8261  |   |   |   |  |
| 1051 |                                                                                                                                          |   |   |        | Approximate Chi Square Value (0.05)                             |   |   | 29.65 |   |   |   |  |
| 1052 | Adjusted Level of Significance                                                                                                           |   |   | 0.0407 | Adjusted Chi Square Value                                       |   |   | 28.95 |   |   |   |  |
| 1053 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1054 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1055 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   |   | 10617  | 95% Adjusted Gamma UCL (use when n<50)                          |   |   | 10872 |   |   |   |  |
| 1056 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1057 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1058 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.978  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |       |   |   |   |  |
| 1059 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.926  | Data appear Lognormal at 5% Significance Level                  |   |   |       |   |   |   |  |
| 1060 | Lilliefors Test Statistic                                                                                                                |   |   | 0.0843 | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |       |   |   |   |  |
| 1061 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.161  | Data appear Lognormal at 5% Significance Level                  |   |   |       |   |   |   |  |
| 1062 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1063 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1064 | <b>Lognormal Statistics</b>                                                                                                              |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1065 | Minimum of Logged Data                                                                                                                   |   |   | 5.849  | Mean of logged Data                                             |   |   | 8.155 |   |   |   |  |
| 1066 | Maximum of Logged Data                                                                                                                   |   |   | 10.93  | SD of logged Data                                               |   |   | 1.268 |   |   |   |  |
| 1067 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1068 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 1069 | 95% H-UCL                                                                                                                                |   |   | 15276  | 90% Chebyshev (MVUE) UCL                                        |   |   | 13756 |   |   |   |  |
| 1070 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 16625  | 97.5% Chebyshev (MVUE) UCL                                      |   |   | 20606 |   |   |   |  |
| 1071 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 28427  |                                                                 |   |   |       |   |   |   |  |
| 1072 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |

|      | A                                                                                                                                        | B | C | D      | E                                                               | F | G | H     | I | J | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------------------|---|---|-------|---|---|---|---|--|
| 1073 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1074 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1075 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1076 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1077 | 95% CLT UCL                                                                                                                              |   |   | 10449  | 95% Jackknife UCL                                               |   |   | 10561 |   |   |   |   |  |
| 1078 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 10356  | 95% Bootstrap-t UCL                                             |   |   | 13786 |   |   |   |   |  |
| 1079 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 24020  | 95% Percentile Bootstrap UCL                                    |   |   | 10711 |   |   |   |   |  |
| 1080 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 12634  |                                                                 |   |   |       |   |   |   |   |  |
| 1081 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 13141  | 95% Chebyshev(Mean, Sd) UCL                                     |   |   | 15841 |   |   |   |   |  |
| 1082 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 19588  | 99% Chebyshev(Mean, Sd) UCL                                     |   |   | 26948 |   |   |   |   |  |
| 1083 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1084 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1085 | 95% Adjusted Gamma UCL                                                                                                                   |   |   | 10872  |                                                                 |   |   |       |   |   |   |   |  |
| 1086 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1087 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1088 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1089 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1090 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1091 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1092 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1093 | <b>Result (eu1_manganese_waste rock)</b>                                                                                                 |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1094 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1095 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1096 | Total Number of Observations                                                                                                             |   |   | 29     | Number of Distinct Observations                                 |   |   | 29    |   |   |   |   |  |
| 1097 |                                                                                                                                          |   |   |        | Number of Missing Observations                                  |   |   | 0     |   |   |   |   |  |
| 1098 | Minimum                                                                                                                                  |   |   | 43     | Mean                                                            |   |   | 1504  |   |   |   |   |  |
| 1099 | Maximum                                                                                                                                  |   |   | 12800  | Median                                                          |   |   | 448   |   |   |   |   |  |
| 1100 | SD                                                                                                                                       |   |   | 2747   | Std. Error of Mean                                              |   |   | 510.2 |   |   |   |   |  |
| 1101 | Coefficient of Variation                                                                                                                 |   |   | 1.827  | Skewness                                                        |   |   | 3.206 |   |   |   |   |  |
| 1102 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1103 | <b>Normal GOF Test</b>                                                                                                                   |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1104 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.555  | <b>Shapiro Wilk GOF Test</b>                                    |   |   |       |   |   |   |   |  |
| 1105 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.926  | Data Not Normal at 5% Significance Level                        |   |   |       |   |   |   |   |  |
| 1106 | Lilliefors Test Statistic                                                                                                                |   |   | 0.307  | <b>Lilliefors GOF Test</b>                                      |   |   |       |   |   |   |   |  |
| 1107 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.161  | Data Not Normal at 5% Significance Level                        |   |   |       |   |   |   |   |  |
| 1108 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1109 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1110 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1111 | <b>95% Normal UCL</b>                                                                                                                    |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |       |   |   |   |   |  |
| 1112 | 95% Student's-t UCL                                                                                                                      |   |   | 2372   | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   | 2668  |   |   |   |   |  |
| 1113 |                                                                                                                                          |   |   |        | 95% Modified-t UCL (Johnson-1978)                               |   |   | 2422  |   |   |   |   |  |
| 1114 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1115 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1116 | A-D Test Statistic                                                                                                                       |   |   | 0.953  | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |       |   |   |   |   |  |
| 1117 | 5% A-D Critical Value                                                                                                                    |   |   | 0.803  | Data Not Gamma Distributed at 5% Significance Level             |   |   |       |   |   |   |   |  |
| 1118 | K-S Test Statistic                                                                                                                       |   |   | 0.143  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |       |   |   |   |   |  |
| 1119 | 5% K-S Critical Value                                                                                                                    |   |   | 0.171  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |   |  |
| 1120 | <b>Detected data follow Appr. Gamma Distribution at 5% Significance Level</b>                                                            |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1121 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1122 | <b>Gamma Statistics</b>                                                                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1123 | k hat (MLE)                                                                                                                              |   |   | 0.579  | k star (bias corrected MLE)                                     |   |   | 0.542 |   |   |   |   |  |
| 1124 | Theta hat (MLE)                                                                                                                          |   |   | 2598   | Theta star (bias corrected MLE)                                 |   |   | 2775  |   |   |   |   |  |
| 1125 | nu hat (MLE)                                                                                                                             |   |   | 33.57  | nu star (bias corrected)                                        |   |   | 31.43 |   |   |   |   |  |
| 1126 | MLE Mean (bias corrected)                                                                                                                |   |   | 1504   | MLE Sd (bias corrected)                                         |   |   | 2043  |   |   |   |   |  |
| 1127 |                                                                                                                                          |   |   |        | Approximate Chi Square Value (0.05)                             |   |   | 19.62 |   |   |   |   |  |
| 1128 | Adjusted Level of Significance                                                                                                           |   |   | 0.0407 | Adjusted Chi Square Value                                       |   |   | 19.06 |   |   |   |   |  |
| 1129 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1130 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1131 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   |   | 2409   | 95% Adjusted Gamma UCL (use when n<50)                          |   |   | 2480  |   |   |   |   |  |
| 1132 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1133 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1134 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.975  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |       |   |   |   |   |  |
| 1135 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.926  | Data appear Lognormal at 5% Significance Level                  |   |   |       |   |   |   |   |  |
| 1136 | Lilliefors Test Statistic                                                                                                                |   |   | 0.0752 | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |       |   |   |   |   |  |
| 1137 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.161  | Data appear Lognormal at 5% Significance Level                  |   |   |       |   |   |   |   |  |
| 1138 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1139 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |

| A    | B                                                                                                                                        | C | D     | E                                                               | F                                                    | G                   | H | I      | J | K     | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|-------|-----------------------------------------------------------------|------------------------------------------------------|---------------------|---|--------|---|-------|---|--|
| 1140 | <b>Lognormal Statistics</b>                                                                                                              |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1141 | Minimum of Logged Data                                                                                                                   |   |       |                                                                 | 3.761                                                | Mean of logged Data |   |        |   | 6.242 |   |  |
| 1142 | Maximum of Logged Data                                                                                                                   |   |       |                                                                 | 9.457                                                | SD of logged Data   |   |        |   | 1.5   |   |  |
| 1143 |                                                                                                                                          |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1144 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1145 | 95% H-UCL                                                                                                                                |   |       | 3865                                                            | 90% Chebyshev (MVUE) UCL                             |                     |   | 3012   |   |       |   |  |
| 1146 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |       | 3711                                                            | 97.5% Chebyshev (MVUE) UCL                           |                     |   | 4682   |   |       |   |  |
| 1147 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |       | 6587                                                            |                                                      |                     |   |        |   |       |   |  |
| 1148 |                                                                                                                                          |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1149 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1150 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1151 |                                                                                                                                          |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1152 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1153 | 95% CLT UCL                                                                                                                              |   |       | 2343                                                            | 95% Jackknife UCL                                    |                     |   | 2372   |   |       |   |  |
| 1154 | 95% Standard Bootstrap UCL                                                                                                               |   |       | 2321                                                            | 95% Bootstrap-t UCL                                  |                     |   | 3668   |   |       |   |  |
| 1155 | 95% Hall's Bootstrap UCL                                                                                                                 |   |       | 5969                                                            | 95% Percentile Bootstrap UCL                         |                     |   | 2438   |   |       |   |  |
| 1156 | 95% BCA Bootstrap UCL                                                                                                                    |   |       | 2683                                                            |                                                      |                     |   |        |   |       |   |  |
| 1157 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |       | 3034                                                            | 95% Chebyshev(Mean, Sd) UCL                          |                     |   | 3728   |   |       |   |  |
| 1158 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |       | 4690                                                            | 99% Chebyshev(Mean, Sd) UCL                          |                     |   | 6580   |   |       |   |  |
| 1159 |                                                                                                                                          |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1160 | <b>Suggested UCL to Use</b>                                                                                                              |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1161 | 95% Adjusted Gamma UCL                                                                                                                   |   |       | 2480                                                            |                                                      |                     |   |        |   |       |   |  |
| 1162 |                                                                                                                                          |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1163 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                           |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1164 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                   |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1165 |                                                                                                                                          |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1166 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1167 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1168 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1169 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1170 |                                                                                                                                          |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1171 | <b>Result (eu1_thallium_overbank)</b>                                                                                                    |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1172 |                                                                                                                                          |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1173 | <b>General Statistics</b>                                                                                                                |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1174 | Total Number of Observations                                                                                                             |   |       | 29                                                              | Number of Distinct Observations                      |                     |   | 20     |   |       |   |  |
| 1175 | Number of Detects                                                                                                                        |   |       | 9                                                               | Number of Non-Detects                                |                     |   | 20     |   |       |   |  |
| 1176 | Number of Distinct Detects                                                                                                               |   |       | 7                                                               | Number of Distinct Non-Detects                       |                     |   | 13     |   |       |   |  |
| 1177 | Minimum Detect                                                                                                                           |   |       | 0.49                                                            | Minimum Non-Detect                                   |                     |   | 0.041  |   |       |   |  |
| 1178 | Maximum Detect                                                                                                                           |   |       | 3.3                                                             | Maximum Non-Detect                                   |                     |   | 0.18   |   |       |   |  |
| 1179 | Variance Detects                                                                                                                         |   |       | 0.724                                                           | Percent Non-Detects                                  |                     |   | 68.97% |   |       |   |  |
| 1180 | Mean Detects                                                                                                                             |   |       | 1.246                                                           | SD Detects                                           |                     |   | 0.851  |   |       |   |  |
| 1181 | Median Detects                                                                                                                           |   |       | 0.79                                                            | CV Detects                                           |                     |   | 0.683  |   |       |   |  |
| 1182 | Skewness Detects                                                                                                                         |   |       | 2.053                                                           | Kurtosis Detects                                     |                     |   | 4.8    |   |       |   |  |
| 1183 | Mean of Logged Detects                                                                                                                   |   |       | 0.0622                                                          | SD of Logged Detects                                 |                     |   | 0.564  |   |       |   |  |
| 1184 |                                                                                                                                          |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1185 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1186 | Shapiro Wilk Test Statistic                                                                                                              |   |       | 0.751                                                           | <b>Shapiro Wilk GOF Test</b>                         |                     |   |        |   |       |   |  |
| 1187 | 5% Shapiro Wilk Critical Value                                                                                                           |   |       | 0.829                                                           | Detected Data Not Normal at 5% Significance Level    |                     |   |        |   |       |   |  |
| 1188 | Lilliefors Test Statistic                                                                                                                |   |       | 0.271                                                           | <b>Lilliefors GOF Test</b>                           |                     |   |        |   |       |   |  |
| 1189 | 5% Lilliefors Critical Value                                                                                                             |   |       | 0.274                                                           | Detected Data appear Normal at 5% Significance Level |                     |   |        |   |       |   |  |
| 1190 | <b>Detected Data appear Approximate Normal at 5% Significance Level</b>                                                                  |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1191 |                                                                                                                                          |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1192 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1193 | KM Mean                                                                                                                                  |   | 0.415 | KM Standard Error of Mean                                       |                                                      | 0.141               |   |        |   |       |   |  |
| 1194 | KM SD                                                                                                                                    |   | 0.714 | 95% KM (BCA) UCL                                                |                                                      | 0.699               |   |        |   |       |   |  |
| 1195 | 95% KM (t) UCL                                                                                                                           |   | 0.654 | 95% KM (Percentile Bootstrap) UCL                               |                                                      | 0.631               |   |        |   |       |   |  |
| 1196 | 95% KM (z) UCL                                                                                                                           |   | 0.646 | 95% KM Bootstrap t UCL                                          |                                                      | 0.768               |   |        |   |       |   |  |
| 1197 | 90% KM Chebyshev UCL                                                                                                                     |   | 0.837 | 95% KM Chebyshev UCL                                            |                                                      | 1.028               |   |        |   |       |   |  |
| 1198 | 97.5% KM Chebyshev UCL                                                                                                                   |   | 1.293 | 99% KM Chebyshev UCL                                            |                                                      | 1.815               |   |        |   |       |   |  |
| 1199 |                                                                                                                                          |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1200 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1201 | A-D Test Statistic                                                                                                                       |   | 0.616 | <b>Anderson-Darling GOF Test</b>                                |                                                      |                     |   |        |   |       |   |  |
| 1202 | 5% A-D Critical Value                                                                                                                    |   | 0.726 | Detected data appear Gamma Distributed at 5% Significance Level |                                                      |                     |   |        |   |       |   |  |
| 1203 | K-S Test Statistic                                                                                                                       |   | 0.276 | <b>Kolmogorov-Smirnov GOF</b>                                   |                                                      |                     |   |        |   |       |   |  |
| 1204 | 5% K-S Critical Value                                                                                                                    |   | 0.281 | Detected data appear Gamma Distributed at 5% Significance Level |                                                      |                     |   |        |   |       |   |  |
| 1205 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |
| 1206 |                                                                                                                                          |   |       |                                                                 |                                                      |                     |   |        |   |       |   |  |

|      | A                                                                                                                         | B | C | D      | E                                                       | F | G                           | H      | I | J | K | L |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|--------|---------------------------------------------------------|---|-----------------------------|--------|---|---|---|---|
| 1207 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1208 | k hat (MLE)                                                                                                               |   |   | 3.334  | k star (bias corrected MLE)                             |   |                             | 2.297  |   |   |   |   |
| 1209 | Theta hat (MLE)                                                                                                           |   |   | 0.374  | Theta star (bias corrected MLE)                         |   |                             | 0.542  |   |   |   |   |
| 1210 | nu hat (MLE)                                                                                                              |   |   | 60.01  | nu star (bias corrected)                                |   |                             | 41.34  |   |   |   |   |
| 1211 | Mean (detects)                                                                                                            |   |   | 1.246  |                                                         |   |                             |        |   |   |   |   |
| 1212 |                                                                                                                           |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1213 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1214 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1215 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1216 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1217 | This is especially true when the sample size is small.                                                                    |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1218 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1219 | Minimum                                                                                                                   |   |   | 0.01   | Mean                                                    |   |                             | 0.393  |   |   |   |   |
| 1220 | Maximum                                                                                                                   |   |   | 3.3    | Median                                                  |   |                             | 0.01   |   |   |   |   |
| 1221 | SD                                                                                                                        |   |   | 0.738  | CV                                                      |   |                             | 1.877  |   |   |   |   |
| 1222 | k hat (MLE)                                                                                                               |   |   | 0.309  | k star (bias corrected MLE)                             |   |                             | 0.3    |   |   |   |   |
| 1223 | Theta hat (MLE)                                                                                                           |   |   | 1.275  | Theta star (bias corrected MLE)                         |   |                             | 1.313  |   |   |   |   |
| 1224 | nu hat (MLE)                                                                                                              |   |   | 17.9   | nu star (bias corrected)                                |   |                             | 17.38  |   |   |   |   |
| 1225 | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   | 0.0407 |                                                         |   |                             |        |   |   |   |   |
| 1226 | Approximate Chi Square Value (17.38, $\alpha$ )                                                                           |   |   | 8.946  | Adjusted Chi Square Value (17.38, $\beta$ )             |   |                             | 8.585  |   |   |   |   |
| 1227 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   | 0.764  | 95% Gamma Adjusted UCL (use when $n < 50$ )             |   |                             | 0.797  |   |   |   |   |
| 1228 |                                                                                                                           |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1229 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1230 | Mean (KM)                                                                                                                 |   |   | 0.415  | SD (KM)                                                 |   |                             | 0.714  |   |   |   |   |
| 1231 | Variance (KM)                                                                                                             |   |   | 0.51   | SE of Mean (KM)                                         |   |                             | 0.141  |   |   |   |   |
| 1232 | k hat (KM)                                                                                                                |   |   | 0.337  | k star (KM)                                             |   |                             | 0.325  |   |   |   |   |
| 1233 | nu hat (KM)                                                                                                               |   |   | 19.56  | nu star (KM)                                            |   |                             | 18.87  |   |   |   |   |
| 1234 | theta hat (KM)                                                                                                            |   |   | 1.23   | theta star (KM)                                         |   |                             | 1.275  |   |   |   |   |
| 1235 | 80% gamma percentile (KM)                                                                                                 |   |   | 0.648  | 90% gamma percentile (KM)                               |   |                             | 1.211  |   |   |   |   |
| 1236 | 95% gamma percentile (KM)                                                                                                 |   |   | 1.848  | 99% gamma percentile (KM)                               |   |                             | 3.489  |   |   |   |   |
| 1237 |                                                                                                                           |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1238 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1239 | Approximate Chi Square Value (18.87, $\alpha$ )                                                                           |   |   | 10.02  | Adjusted Chi Square Value (18.87, $\beta$ )             |   |                             | 9.637  |   |   |   |   |
| 1240 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   |   | 0.781  | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )          |   |                             | 0.812  |   |   |   |   |
| 1241 |                                                                                                                           |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1242 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1243 | Shapiro Wilk Test Statistic                                                                                               |   |   | 0.908  | <b>Shapiro Wilk GOF Test</b>                            |   |                             |        |   |   |   |   |
| 1244 | 5% Shapiro Wilk Critical Value                                                                                            |   |   | 0.829  | Detected Data appear Lognormal at 5% Significance Level |   |                             |        |   |   |   |   |
| 1245 | Lilliefors Test Statistic                                                                                                 |   |   | 0.257  | <b>Lilliefors GOF Test</b>                              |   |                             |        |   |   |   |   |
| 1246 | 5% Lilliefors Critical Value                                                                                              |   |   | 0.274  | Detected Data appear Lognormal at 5% Significance Level |   |                             |        |   |   |   |   |
| 1247 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                            |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1248 |                                                                                                                           |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1249 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1250 | Mean in Original Scale                                                                                                    |   |   | 0.499  | Mean in Log Scale                                       |   |                             | -1.279 |   |   |   |   |
| 1251 | SD in Original Scale                                                                                                      |   |   | 0.685  | SD in Log Scale                                         |   |                             | 1.02   |   |   |   |   |
| 1252 | 95% t UCL (assumes normality of ROS data)                                                                                 |   |   | 0.716  | 95% Percentile Bootstrap UCL                            |   |                             | 0.724  |   |   |   |   |
| 1253 | 95% BCA Bootstrap UCL                                                                                                     |   |   | 0.787  | 95% Bootstrap t UCL                                     |   |                             | 0.884  |   |   |   |   |
| 1254 | 95% H-UCL (Log ROS)                                                                                                       |   |   | 0.757  |                                                         |   |                             |        |   |   |   |   |
| 1255 |                                                                                                                           |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1256 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1257 | KM Mean (logged)                                                                                                          |   |   | -2.184 | KM Geo Mean                                             |   |                             | 0.113  |   |   |   |   |
| 1258 | KM SD (logged)                                                                                                            |   |   | 1.535  | 95% Critical H Value (KM-Log)                           |   |                             | 3.199  |   |   |   |   |
| 1259 | KM Standard Error of Mean (logged)                                                                                        |   |   | 0.302  | 95% H-UCL (KM -Log)                                     |   |                             | 0.926  |   |   |   |   |
| 1260 | KM SD (logged)                                                                                                            |   |   | 1.535  | 95% Critical H Value (KM-Log)                           |   |                             | 3.199  |   |   |   |   |
| 1261 | KM Standard Error of Mean (logged)                                                                                        |   |   | 0.302  |                                                         |   |                             |        |   |   |   |   |
| 1262 |                                                                                                                           |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1263 | <b>DL/2 Statistics</b>                                                                                                    |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1264 | <b>DL/2 Normal</b>                                                                                                        |   |   |        |                                                         |   | <b>DL/2 Log-Transformed</b> |        |   |   |   |   |
| 1265 | Mean in Original Scale                                                                                                    |   |   | 0.407  | Mean in Log Scale                                       |   |                             | -2.467 |   |   |   |   |
| 1266 | SD in Original Scale                                                                                                      |   |   | 0.731  | SD in Log Scale                                         |   |                             | 1.778  |   |   |   |   |
| 1267 | 95% t UCL (Assumes normality)                                                                                             |   |   | 0.638  | 95% H-Stat UCL                                          |   |                             | 1.367  |   |   |   |   |
| 1268 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                  |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1269 |                                                                                                                           |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1270 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                     |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1271 | Detected Data appear Approximate Normal Distributed at 5% Significance Level                                              |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1272 |                                                                                                                           |   |   |        |                                                         |   |                             |        |   |   |   |   |
| 1273 | <b>Suggested UCL to Use</b>                                                                                               |   |   |        |                                                         |   |                             |        |   |   |   |   |

|      | A | B | C | D                                                                                                                                        | E | F      | G | H | I | J                                                               | K | L      |
|------|---|---|---|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|---|---|---|-----------------------------------------------------------------|---|--------|
| 1274 |   |   |   | 95% KM (t) UCL                                                                                                                           |   | 0.654  |   |   |   |                                                                 |   |        |
| 1275 |   |   |   |                                                                                                                                          |   |        |   |   |   |                                                                 |   |        |
| 1276 |   |   |   | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                           |   |        |   |   |   |                                                                 |   |        |
| 1277 |   |   |   | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                   |   |        |   |   |   |                                                                 |   |        |
| 1278 |   |   |   |                                                                                                                                          |   |        |   |   |   |                                                                 |   |        |
| 1279 |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |   |   |   |                                                                 |   |        |
| 1280 |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |   |   |   |                                                                 |   |        |
| 1281 |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |   |   |   |                                                                 |   |        |
| 1282 |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |   |   |   |                                                                 |   |        |
| 1283 |   |   |   |                                                                                                                                          |   |        |   |   |   |                                                                 |   |        |
| 1284 |   |   |   | <b>Result (eu1_thallium_waste rock)</b>                                                                                                  |   |        |   |   |   |                                                                 |   |        |
| 1285 |   |   |   |                                                                                                                                          |   |        |   |   |   |                                                                 |   |        |
| 1286 |   |   |   | <b>General Statistics</b>                                                                                                                |   |        |   |   |   |                                                                 |   |        |
| 1287 |   |   |   | Total Number of Observations                                                                                                             |   | 29     |   |   |   | Number of Distinct Observations                                 |   | 22     |
| 1288 |   |   |   | Number of Detects                                                                                                                        |   | 25     |   |   |   | Number of Non-Detects                                           |   | 4      |
| 1289 |   |   |   | Number of Distinct Detects                                                                                                               |   | 21     |   |   |   | Number of Distinct Non-Detects                                  |   | 1      |
| 1290 |   |   |   | Minimum Detect                                                                                                                           |   | 0.2    |   |   |   | Minimum Non-Detect                                              |   | 0.003  |
| 1291 |   |   |   | Maximum Detect                                                                                                                           |   | 6      |   |   |   | Maximum Non-Detect                                              |   | 0.003  |
| 1292 |   |   |   | Variance Detects                                                                                                                         |   | 2.28   |   |   |   | Percent Non-Detects                                             |   | 13.79% |
| 1293 |   |   |   | Mean Detects                                                                                                                             |   | 1.876  |   |   |   | SD Detects                                                      |   | 1.51   |
| 1294 |   |   |   | Median Detects                                                                                                                           |   | 1.4    |   |   |   | CV Detects                                                      |   | 0.805  |
| 1295 |   |   |   | Skewness Detects                                                                                                                         |   | 1.408  |   |   |   | Kurtosis Detects                                                |   | 1.393  |
| 1296 |   |   |   | Mean of Logged Detects                                                                                                                   |   | 0.335  |   |   |   | SD of Logged Detects                                            |   | 0.803  |
| 1297 |   |   |   |                                                                                                                                          |   |        |   |   |   |                                                                 |   |        |
| 1298 |   |   |   | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |        |   |   |   |                                                                 |   |        |
| 1299 |   |   |   | Shapiro Wilk Test Statistic                                                                                                              |   | 0.835  |   |   |   | <b>Shapiro Wilk GOF Test</b>                                    |   |        |
| 1300 |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.918  |   |   |   | Detected Data Not Normal at 5% Significance Level               |   |        |
| 1301 |   |   |   | Lilliefors Test Statistic                                                                                                                |   | 0.189  |   |   |   | <b>Lilliefors GOF Test</b>                                      |   |        |
| 1302 |   |   |   | 5% Lilliefors Critical Value                                                                                                             |   | 0.173  |   |   |   | Detected Data Not Normal at 5% Significance Level               |   |        |
| 1303 |   |   |   | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |   |        |   |   |   |                                                                 |   |        |
| 1304 |   |   |   |                                                                                                                                          |   |        |   |   |   |                                                                 |   |        |
| 1305 |   |   |   | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |        |   |   |   |                                                                 |   |        |
| 1306 |   |   |   | KM Mean                                                                                                                                  |   | 1.617  |   |   |   | KM Standard Error of Mean                                       |   | 0.288  |
| 1307 |   |   |   | KM SD                                                                                                                                    |   | 1.518  |   |   |   | 95% KM (BCA) UCL                                                |   | 2.126  |
| 1308 |   |   |   | 95% KM (t) UCL                                                                                                                           |   | 2.107  |   |   |   | 95% KM (Percentile Bootstrap) UCL                               |   | 2.112  |
| 1309 |   |   |   | 95% KM (z) UCL                                                                                                                           |   | 2.09   |   |   |   | 95% KM Bootstrap t UCL                                          |   | 2.24   |
| 1310 |   |   |   | 90% KM Chebyshev UCL                                                                                                                     |   | 2.48   |   |   |   | 95% KM Chebyshev UCL                                            |   | 2.871  |
| 1311 |   |   |   | 97.5% KM Chebyshev UCL                                                                                                                   |   | 3.414  |   |   |   | 99% KM Chebyshev UCL                                            |   | 4.479  |
| 1312 |   |   |   |                                                                                                                                          |   |        |   |   |   |                                                                 |   |        |
| 1313 |   |   |   | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |   |        |   |   |   |                                                                 |   |        |
| 1314 |   |   |   | A-D Test Statistic                                                                                                                       |   | 0.52   |   |   |   | <b>Anderson-Darling GOF Test</b>                                |   |        |
| 1315 |   |   |   | 5% A-D Critical Value                                                                                                                    |   | 0.758  |   |   |   | detected data appear Gamma Distributed at 5% Significance Level |   |        |
| 1316 |   |   |   | K-S Test Statistic                                                                                                                       |   | 0.139  |   |   |   | <b>Kolmogorov-Smirnov GOF</b>                                   |   |        |
| 1317 |   |   |   | 5% K-S Critical Value                                                                                                                    |   | 0.177  |   |   |   | detected data appear Gamma Distributed at 5% Significance Level |   |        |
| 1318 |   |   |   | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |        |   |   |   |                                                                 |   |        |
| 1319 |   |   |   |                                                                                                                                          |   |        |   |   |   |                                                                 |   |        |
| 1320 |   |   |   | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |   |        |   |   |   |                                                                 |   |        |
| 1321 |   |   |   | k hat (MLE)                                                                                                                              |   | 1.849  |   |   |   | k star (bias corrected MLE)                                     |   | 1.654  |
| 1322 |   |   |   | Theta hat (MLE)                                                                                                                          |   | 1.014  |   |   |   | Theta star (bias corrected MLE)                                 |   | 1.134  |
| 1323 |   |   |   | nu hat (MLE)                                                                                                                             |   | 92.45  |   |   |   | nu star (bias corrected)                                        |   | 82.69  |
| 1324 |   |   |   | Mean (detects)                                                                                                                           |   | 1.876  |   |   |   |                                                                 |   |        |
| 1325 |   |   |   |                                                                                                                                          |   |        |   |   |   |                                                                 |   |        |
| 1326 |   |   |   | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |   |        |   |   |   |                                                                 |   |        |
| 1327 |   |   |   | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |   |        |   |   |   |                                                                 |   |        |
| 1328 |   |   |   | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |   |        |   |   |   |                                                                 |   |        |
| 1329 |   |   |   | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |   |        |   |   |   |                                                                 |   |        |
| 1330 |   |   |   | This is especially true when the sample size is small.                                                                                   |   |        |   |   |   |                                                                 |   |        |
| 1331 |   |   |   | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |   |        |   |   |   |                                                                 |   |        |
| 1332 |   |   |   | Minimum                                                                                                                                  |   | 0.01   |   |   |   | Mean                                                            |   | 1.618  |
| 1333 |   |   |   | Maximum                                                                                                                                  |   | 6      |   |   |   | Median                                                          |   | 1      |
| 1334 |   |   |   | SD                                                                                                                                       |   | 1.544  |   |   |   | CV                                                              |   | 0.954  |
| 1335 |   |   |   | k hat (MLE)                                                                                                                              |   | 0.726  |   |   |   | k star (bias corrected MLE)                                     |   | 0.674  |
| 1336 |   |   |   | Theta hat (MLE)                                                                                                                          |   | 2.228  |   |   |   | Theta star (bias corrected MLE)                                 |   | 2.401  |
| 1337 |   |   |   | nu hat (MLE)                                                                                                                             |   | 42.12  |   |   |   | nu star (bias corrected)                                        |   | 39.1   |
| 1338 |   |   |   | Adjusted Level of Significance ( $\beta$ )                                                                                               |   | 0.0407 |   |   |   |                                                                 |   |        |
| 1339 |   |   |   | Approximate Chi Square Value (39.10, $\alpha$ )                                                                                          |   | 25.77  |   |   |   | Adjusted Chi Square Value (39.10, $\beta$ )                     |   | 25.13  |
| 1340 |   |   |   | 95% Gamma Approximate UCL (use when n $\geq$ 50)                                                                                         |   | 2.455  |   |   |   | 95% Gamma Adjusted UCL (use when n<50)                          |   | 2.518  |

| A    | B                                                                                                                                        | C      | D | E | F | G                           | H | I | J                                                       | K      | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------|---|---|---|-----------------------------|---|---|---------------------------------------------------------|--------|---|
| 1341 |                                                                                                                                          |        |   |   |   |                             |   |   |                                                         |        |   |
| 1342 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |        |   |   |   |                             |   |   |                                                         |        |   |
| 1343 | Mean (KM)                                                                                                                                | 1.617  |   |   |   |                             |   |   | SD (KM)                                                 | 1.518  |   |
| 1344 | Variance (KM)                                                                                                                            | 2.304  |   |   |   |                             |   |   | SE of Mean (KM)                                         | 0.288  |   |
| 1345 | k hat (KM)                                                                                                                               | 1.136  |   |   |   |                             |   |   | k star (KM)                                             | 1.041  |   |
| 1346 | nu hat (KM)                                                                                                                              | 65.86  |   |   |   |                             |   |   | nu star (KM)                                            | 60.38  |   |
| 1347 | theta hat (KM)                                                                                                                           | 1.424  |   |   |   |                             |   |   | theta star (KM)                                         | 1.554  |   |
| 1348 | 80% gamma percentile (KM)                                                                                                                | 2.594  |   |   |   |                             |   |   | 90% gamma percentile (KM)                               | 3.687  |   |
| 1349 | 95% gamma percentile (KM)                                                                                                                | 4.777  |   |   |   |                             |   |   | 99% gamma percentile (KM)                               | 7.299  |   |
| 1350 |                                                                                                                                          |        |   |   |   |                             |   |   |                                                         |        |   |
| 1351 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |        |   |   |   |                             |   |   |                                                         |        |   |
| 1352 | Approximate Chi Square Value (60.38, $\alpha$ )                                                                                          | 43.51  |   |   |   |                             |   |   | Adjusted Chi Square Value (60.38, $\beta$ )             | 42.66  |   |
| 1353 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                      | 2.244  |   |   |   |                             |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )          | 2.289  |   |
| 1354 |                                                                                                                                          |        |   |   |   |                             |   |   |                                                         |        |   |
| 1355 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |        |   |   |   |                             |   |   |                                                         |        |   |
| 1356 | Shapiro Wilk Test Statistic                                                                                                              | 0.966  |   |   |   |                             |   |   | <b>Shapiro Wilk GOF Test</b>                            |        |   |
| 1357 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.918  |   |   |   |                             |   |   | Detected Data appear Lognormal at 5% Significance Level |        |   |
| 1358 | Lilliefors Test Statistic                                                                                                                | 0.106  |   |   |   |                             |   |   | <b>Lilliefors GOF Test</b>                              |        |   |
| 1359 | 5% Lilliefors Critical Value                                                                                                             | 0.173  |   |   |   |                             |   |   | Detected Data appear Lognormal at 5% Significance Level |        |   |
| 1360 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                           |        |   |   |   |                             |   |   |                                                         |        |   |
| 1361 |                                                                                                                                          |        |   |   |   |                             |   |   |                                                         |        |   |
| 1362 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |        |   |   |   |                             |   |   |                                                         |        |   |
| 1363 | Mean in Original Scale                                                                                                                   | 1.649  |   |   |   |                             |   |   | Mean in Log Scale                                       | 0.0811 |   |
| 1364 | SD in Original Scale                                                                                                                     | 1.513  |   |   |   |                             |   |   | SD in Log Scale                                         | 0.989  |   |
| 1365 | 95% t UCL (assumes normality of ROS data)                                                                                                | 2.126  |   |   |   |                             |   |   | 95% Percentile Bootstrap UCL                            | 2.124  |   |
| 1366 | 95% BCA Bootstrap UCL                                                                                                                    | 2.184  |   |   |   |                             |   |   | 95% Bootstrap t UCL                                     | 2.25   |   |
| 1367 | 95% H-UCL (Log ROS)                                                                                                                      | 2.8    |   |   |   |                             |   |   |                                                         |        |   |
| 1368 |                                                                                                                                          |        |   |   |   |                             |   |   |                                                         |        |   |
| 1369 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |        |   |   |   |                             |   |   |                                                         |        |   |
| 1370 | KM Mean (logged)                                                                                                                         | -0.513 |   |   |   |                             |   |   | KM Geo Mean                                             | 0.599  |   |
| 1371 | KM SD (logged)                                                                                                                           | 2.241  |   |   |   |                             |   |   | 95% Critical H Value (KM-Log)                           | 4.293  |   |
| 1372 | KM Standard Error of Mean (logged)                                                                                                       | 0.425  |   |   |   |                             |   |   | 95% H-UCL (KM -Log)                                     | 45.43  |   |
| 1373 | KM SD (logged)                                                                                                                           | 2.241  |   |   |   |                             |   |   | 95% Critical H Value (KM-Log)                           | 4.293  |   |
| 1374 | KM Standard Error of Mean (logged)                                                                                                       | 0.425  |   |   |   |                             |   |   |                                                         |        |   |
| 1375 |                                                                                                                                          |        |   |   |   |                             |   |   |                                                         |        |   |
| 1376 | <b>DL/2 Statistics</b>                                                                                                                   |        |   |   |   |                             |   |   |                                                         |        |   |
| 1377 | <b>DL/2 Normal</b>                                                                                                                       |        |   |   |   | <b>DL/2 Log-Transformed</b> |   |   |                                                         |        |   |
| 1378 | Mean in Original Scale                                                                                                                   | 1.617  |   |   |   |                             |   |   | Mean in Log Scale                                       | -0.608 |   |
| 1379 | SD in Original Scale                                                                                                                     | 1.545  |   |   |   |                             |   |   | SD in Log Scale                                         | 2.512  |   |
| 1380 | 95% t UCL (Assumes normality)                                                                                                            | 2.105  |   |   |   |                             |   |   | 95% H-Stat UCL                                          | 120.7  |   |
| 1381 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |        |   |   |   |                             |   |   |                                                         |        |   |
| 1382 |                                                                                                                                          |        |   |   |   |                             |   |   |                                                         |        |   |
| 1383 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |   |   |   |                             |   |   |                                                         |        |   |
| 1384 | <b>Detected Data appear Gamma Distributed at 5% Significance Level</b>                                                                   |        |   |   |   |                             |   |   |                                                         |        |   |
| 1385 |                                                                                                                                          |        |   |   |   |                             |   |   |                                                         |        |   |
| 1386 | <b>Suggested UCL to Use</b>                                                                                                              |        |   |   |   |                             |   |   |                                                         |        |   |
| 1387 | 95% KM Adjusted Gamma UCL                                                                                                                | 2.289  |   |   |   |                             |   |   | 95% GROS Adjusted Gamma UCL                             | 2.518  |   |
| 1388 |                                                                                                                                          |        |   |   |   |                             |   |   |                                                         |        |   |
| 1389 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |   |   |   |                             |   |   |                                                         |        |   |
| 1390 | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |   |   |   |                             |   |   |                                                         |        |   |
| 1391 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |   |   |   |                             |   |   |                                                         |        |   |
| 1392 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |   |   |   |                             |   |   |                                                         |        |   |
| 1393 |                                                                                                                                          |        |   |   |   |                             |   |   |                                                         |        |   |
| 1394 |                                                                                                                                          |        |   |   |   |                             |   |   |                                                         |        |   |
| 1395 | <b>Result (eu1_zinc_overbank)</b>                                                                                                        |        |   |   |   |                             |   |   |                                                         |        |   |
| 1396 |                                                                                                                                          |        |   |   |   |                             |   |   |                                                         |        |   |
| 1397 | <b>General Statistics</b>                                                                                                                |        |   |   |   |                             |   |   |                                                         |        |   |
| 1398 | Total Number of Observations                                                                                                             | 29     |   |   |   |                             |   |   | Number of Distinct Observations                         | 28     |   |
| 1399 |                                                                                                                                          |        |   |   |   |                             |   |   | Number of Missing Observations                          | 0      |   |
| 1400 | Minimum                                                                                                                                  | 107    |   |   |   |                             |   |   | Mean                                                    | 1766   |   |
| 1401 | Maximum                                                                                                                                  | 30200  |   |   |   |                             |   |   | Median                                                  | 480    |   |
| 1402 | SD                                                                                                                                       | 5499   |   |   |   |                             |   |   | Std. Error of Mean                                      | 1021   |   |
| 1403 | Coefficient of Variation                                                                                                                 | 3.113  |   |   |   |                             |   |   | Skewness                                                | 5.29   |   |
| 1404 |                                                                                                                                          |        |   |   |   |                             |   |   |                                                         |        |   |
| 1405 | <b>Normal GOF Test</b>                                                                                                                   |        |   |   |   |                             |   |   |                                                         |        |   |
| 1406 | Shapiro Wilk Test Statistic                                                                                                              | 0.271  |   |   |   |                             |   |   | <b>Shapiro Wilk GOF Test</b>                            |        |   |
| 1407 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.926  |   |   |   |                             |   |   | Data Not Normal at 5% Significance Level                |        |   |

| A    | B                                                                                                                                        | C | D | E      | F                                                   | G                                       | H | I | J | K     | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------|-----------------------------------------|---|---|---|-------|---|
| 1408 | Lilliefors Test Statistic                                                                                                                |   |   | 0.435  | <b>Lilliefors GOF Test</b>                          |                                         |   |   |   |       |   |
| 1409 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.161  | Data Not Normal at 5% Significance Level            |                                         |   |   |   |       |   |
| 1410 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1411 |                                                                                                                                          |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1412 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1413 | <b>95% Normal UCL</b>                                                                                                                    |   |   |        |                                                     | <b>95% UCLs (Adjusted for Skewness)</b> |   |   |   |       |   |
| 1414 | 95% Student's-t UCL                                                                                                                      |   |   | 3504   | 95% Adjusted-CLT UCL (Chen-1995)                    |                                         |   |   |   | 4518  |   |
| 1415 |                                                                                                                                          |   |   |        | 95% Modified-t UCL (Johnson-1978)                   |                                         |   |   |   | 3671  |   |
| 1416 |                                                                                                                                          |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1417 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1418 | A-D Test Statistic                                                                                                                       |   |   | 3.299  | <b>Anderson-Darling Gamma GOF Test</b>              |                                         |   |   |   |       |   |
| 1419 | 5% A-D Critical Value                                                                                                                    |   |   | 0.8    | Data Not Gamma Distributed at 5% Significance Level |                                         |   |   |   |       |   |
| 1420 | K-S Test Statistic                                                                                                                       |   |   | 0.259  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |                                         |   |   |   |       |   |
| 1421 | 5% K-S Critical Value                                                                                                                    |   |   | 0.171  | Data Not Gamma Distributed at 5% Significance Level |                                         |   |   |   |       |   |
| 1422 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1423 |                                                                                                                                          |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1424 | <b>Gamma Statistics</b>                                                                                                                  |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1425 | k hat (MLE)                                                                                                                              |   |   | 0.602  | k star (bias corrected MLE)                         |                                         |   |   |   | 0.563 |   |
| 1426 | Theta hat (MLE)                                                                                                                          |   |   | 2932   | Theta star (bias corrected MLE)                     |                                         |   |   |   | 3137  |   |
| 1427 | nu hat (MLE)                                                                                                                             |   |   | 34.94  | nu star (bias corrected)                            |                                         |   |   |   | 32.66 |   |
| 1428 | MLE Mean (bias corrected)                                                                                                                |   |   | 1766   | MLE Sd (bias corrected)                             |                                         |   |   |   | 2354  |   |
| 1429 |                                                                                                                                          |   |   |        | Approximate Chi Square Value (0.05)                 |                                         |   |   |   | 20.6  |   |
| 1430 | Adjusted Level of Significance                                                                                                           |   |   | 0.0407 | Adjusted Chi Square Value                           |                                         |   |   |   | 20.02 |   |
| 1431 |                                                                                                                                          |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1432 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1433 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |   | 2801   | 95% Adjusted Gamma UCL (use when n<50)              |                                         |   |   |   | 2881  |   |
| 1434 |                                                                                                                                          |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1435 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1436 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.905  | <b>Shapiro Wilk Lognormal GOF Test</b>              |                                         |   |   |   |       |   |
| 1437 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.926  | Data Not Lognormal at 5% Significance Level         |                                         |   |   |   |       |   |
| 1438 | Lilliefors Test Statistic                                                                                                                |   |   | 0.117  | <b>Lilliefors Lognormal GOF Test</b>                |                                         |   |   |   |       |   |
| 1439 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.161  | Data appear Lognormal at 5% Significance Level      |                                         |   |   |   |       |   |
| 1440 | <b>Data appear Approximate Lognormal at 5% Significance Level</b>                                                                        |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1441 |                                                                                                                                          |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1442 | <b>Lognormal Statistics</b>                                                                                                              |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1443 | Minimum of Logged Data                                                                                                                   |   |   | 4.673  | Mean of logged Data                                 |                                         |   |   |   | 6.452 |   |
| 1444 | Maximum of Logged Data                                                                                                                   |   |   | 10.32  | SD of logged Data                                   |                                         |   |   |   | 1.103 |   |
| 1445 |                                                                                                                                          |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1446 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1447 | 95% H-UCL                                                                                                                                |   |   | 1999   | 90% Chebyshev (MVUE) UCL                            |                                         |   |   |   | 1938  |   |
| 1448 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 2305   | 97.5% Chebyshev (MVUE) UCL                          |                                         |   |   |   | 2814  |   |
| 1449 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 3815   |                                                     |                                         |   |   |   |       |   |
| 1450 |                                                                                                                                          |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1451 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1452 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1453 |                                                                                                                                          |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1454 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1455 | 95% CLT UCL                                                                                                                              |   |   | 3446   | 95% Jackknife UCL                                   |                                         |   |   |   | 3504  |   |
| 1456 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 3452   | 95% Bootstrap-t UCL                                 |                                         |   |   |   | 14238 |   |
| 1457 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 10039  | 95% Percentile Bootstrap UCL                        |                                         |   |   |   | 3827  |   |
| 1458 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 4965   |                                                     |                                         |   |   |   |       |   |
| 1459 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 4830   | 95% Chebyshev(Mean, Sd) UCL                         |                                         |   |   |   | 6218  |   |
| 1460 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 8144   | 99% Chebyshev(Mean, Sd) UCL                         |                                         |   |   |   | 11927 |   |
| 1461 |                                                                                                                                          |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1462 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1463 | 95% H-UCL                                                                                                                                |   |   | 1999   |                                                     |                                         |   |   |   |       |   |
| 1464 |                                                                                                                                          |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1465 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1466 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1467 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1468 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1469 |                                                                                                                                          |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1470 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1471 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1472 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1473 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |   |   |        |                                                     |                                         |   |   |   |       |   |
| 1474 |                                                                                                                                          |   |   |        |                                                     |                                         |   |   |   |       |   |

| A    | B                                                                                | C      | D | E | F | G                                       | H                                                               | I     | J | K | L |
|------|----------------------------------------------------------------------------------|--------|---|---|---|-----------------------------------------|-----------------------------------------------------------------|-------|---|---|---|
| 1475 |                                                                                  |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1476 | Result (eu1_zinc_waste rock)                                                     |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1477 |                                                                                  |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1478 | <b>General Statistics</b>                                                        |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1479 | Total Number of Observations                                                     | 29     |   |   |   |                                         | Number of Distinct Observations                                 | 29    |   |   |   |
| 1480 |                                                                                  |        |   |   |   |                                         | Number of Missing Observations                                  | 0     |   |   |   |
| 1481 | Minimum                                                                          | 295    |   |   |   |                                         | Mean                                                            | 4729  |   |   |   |
| 1482 | Maximum                                                                          | 20200  |   |   |   |                                         | Median                                                          | 2010  |   |   |   |
| 1483 | SD                                                                               | 5327   |   |   |   |                                         | Std. Error of Mean                                              | 989.2 |   |   |   |
| 1484 | Coefficient of Variation                                                         | 1.127  |   |   |   |                                         | Skewness                                                        | 1.467 |   |   |   |
| 1485 |                                                                                  |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1486 | <b>Normal GOF Test</b>                                                           |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1487 | Shapiro Wilk Test Statistic                                                      | 0.788  |   |   |   |                                         | <b>Shapiro Wilk GOF Test</b>                                    |       |   |   |   |
| 1488 | 5% Shapiro Wilk Critical Value                                                   | 0.926  |   |   |   |                                         | Data Not Normal at 5% Significance Level                        |       |   |   |   |
| 1489 | Lilliefors Test Statistic                                                        | 0.268  |   |   |   |                                         | <b>Lilliefors GOF Test</b>                                      |       |   |   |   |
| 1490 | 5% Lilliefors Critical Value                                                     | 0.161  |   |   |   |                                         | Data Not Normal at 5% Significance Level                        |       |   |   |   |
| 1491 | <b>Data Not Normal at 5% Significance Level</b>                                  |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1492 |                                                                                  |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1493 | <b>Assuming Normal Distribution</b>                                              |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1494 | <b>95% Normal UCL</b>                                                            |        |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |                                                                 |       |   |   |   |
| 1495 | 95% Student's-t UCL                                                              | 6412   |   |   |   |                                         | 95% Adjusted-CLT UCL (Chen-1995)                                | 6644  |   |   |   |
| 1496 |                                                                                  |        |   |   |   |                                         | 95% Modified-t UCL (Johnson-1978)                               | 6457  |   |   |   |
| 1497 |                                                                                  |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1498 | <b>Gamma GOF Test</b>                                                            |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1499 | A-D Test Statistic                                                               | 0.692  |   |   |   |                                         | <b>Anderson-Darling Gamma GOF Test</b>                          |       |   |   |   |
| 1500 | 5% A-D Critical Value                                                            | 0.778  |   |   |   |                                         | Detected data appear Gamma Distributed at 5% Significance Level |       |   |   |   |
| 1501 | K-S Test Statistic                                                               | 0.152  |   |   |   |                                         | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |       |   |   |   |
| 1502 | 5% K-S Critical Value                                                            | 0.168  |   |   |   |                                         | Detected data appear Gamma Distributed at 5% Significance Level |       |   |   |   |
| 1503 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>           |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1504 |                                                                                  |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1505 | <b>Gamma Statistics</b>                                                          |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1506 | k hat (MLE)                                                                      | 0.896  |   |   |   |                                         | k star (bias corrected MLE)                                     | 0.826 |   |   |   |
| 1507 | Theta hat (MLE)                                                                  | 5277   |   |   |   |                                         | Theta star (bias corrected MLE)                                 | 5723  |   |   |   |
| 1508 | nu hat (MLE)                                                                     | 51.97  |   |   |   |                                         | nu star (bias corrected)                                        | 47.93 |   |   |   |
| 1509 | MLE Mean (bias corrected)                                                        | 4729   |   |   |   |                                         | MLE Sd (bias corrected)                                         | 5202  |   |   |   |
| 1510 |                                                                                  |        |   |   |   |                                         | Approximate Chi Square Value (0.05)                             | 33.04 |   |   |   |
| 1511 | Adjusted Level of Significance                                                   | 0.0407 |   |   |   |                                         | Adjusted Chi Square Value                                       | 32.3  |   |   |   |
| 1512 |                                                                                  |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1513 | <b>Assuming Gamma Distribution</b>                                               |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1514 | 95% Approximate Gamma UCL (use when n>=50)                                       | 6860   |   |   |   |                                         | 95% Adjusted Gamma UCL (use when n<50)                          | 7017  |   |   |   |
| 1515 |                                                                                  |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1516 | <b>Lognormal GOF Test</b>                                                        |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1517 | Shapiro Wilk Test Statistic                                                      | 0.957  |   |   |   |                                         | <b>Shapiro Wilk Lognormal GOF Test</b>                          |       |   |   |   |
| 1518 | 5% Shapiro Wilk Critical Value                                                   | 0.926  |   |   |   |                                         | Data appear Lognormal at 5% Significance Level                  |       |   |   |   |
| 1519 | Lilliefors Test Statistic                                                        | 0.1    |   |   |   |                                         | <b>Lilliefors Lognormal GOF Test</b>                            |       |   |   |   |
| 1520 | 5% Lilliefors Critical Value                                                     | 0.161  |   |   |   |                                         | Data appear Lognormal at 5% Significance Level                  |       |   |   |   |
| 1521 | <b>Data appear Lognormal at 5% Significance Level</b>                            |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1522 |                                                                                  |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1523 | <b>Lognormal Statistics</b>                                                      |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1524 | Minimum of Logged Data                                                           | 5.687  |   |   |   |                                         | Mean of logged Data                                             | 7.809 |   |   |   |
| 1525 | Maximum of Logged Data                                                           | 9.913  |   |   |   |                                         | SD of logged Data                                               | 1.223 |   |   |   |
| 1526 |                                                                                  |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1527 | <b>Assuming Lognormal Distribution</b>                                           |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1528 | 95% H-UCL                                                                        | 9835   |   |   |   |                                         | 90% Chebyshev (MVUE) UCL                                        | 9056  |   |   |   |
| 1529 | 95% Chebyshev (MVUE) UCL                                                         | 10899  |   |   |   |                                         | 97.5% Chebyshev (MVUE) UCL                                      | 13458 |   |   |   |
| 1530 | 99% Chebyshev (MVUE) UCL                                                         | 18484  |   |   |   |                                         |                                                                 |       |   |   |   |
| 1531 |                                                                                  |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1532 | <b>Nonparametric Distribution Free UCL Statistics</b>                            |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1533 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b> |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1534 |                                                                                  |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1535 | <b>Nonparametric Distribution Free UCLs</b>                                      |        |   |   |   |                                         |                                                                 |       |   |   |   |
| 1536 | 95% CLT UCL                                                                      | 6356   |   |   |   |                                         | 95% Jackknife UCL                                               | 6412  |   |   |   |
| 1537 | 95% Standard Bootstrap UCL                                                       | 6358   |   |   |   |                                         | 95% Bootstrap-t UCL                                             | 6891  |   |   |   |
| 1538 | 95% Hall's Bootstrap UCL                                                         | 6632   |   |   |   |                                         | 95% Percentile Bootstrap UCL                                    | 6355  |   |   |   |
| 1539 | 95% BCA Bootstrap UCL                                                            | 6547   |   |   |   |                                         |                                                                 |       |   |   |   |
| 1540 | 90% Chebyshev(Mean, Sd) UCL                                                      | 7697   |   |   |   |                                         | 95% Chebyshev(Mean, Sd) UCL                                     | 9041  |   |   |   |
| 1541 | 97.5% Chebyshev(Mean, Sd) UCL                                                    | 10907  |   |   |   |                                         | 99% Chebyshev(Mean, Sd) UCL                                     | 14572 |   |   |   |

| A    | B                                                                                                                                        | C | D      | E | F                                                            | G | H      | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|---|--------------------------------------------------------------|---|--------|---|---|---|---|
| 1542 |                                                                                                                                          |   |        |   |                                                              |   |        |   |   |   |   |
| 1543 | <b>Suggested UCL to Use</b>                                                                                                              |   |        |   |                                                              |   |        |   |   |   |   |
| 1544 | 95% Adjusted Gamma UCL                                                                                                                   |   | 7017   |   |                                                              |   |        |   |   |   |   |
| 1545 |                                                                                                                                          |   |        |   |                                                              |   |        |   |   |   |   |
| 1546 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |   |                                                              |   |        |   |   |   |   |
| 1547 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |   |                                                              |   |        |   |   |   |   |
| 1548 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |   |                                                              |   |        |   |   |   |   |
| 1549 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |   |                                                              |   |        |   |   |   |   |
| 1550 |                                                                                                                                          |   |        |   |                                                              |   |        |   |   |   |   |
| 1551 | <b>Result (eu2_antimony_overbank)</b>                                                                                                    |   |        |   |                                                              |   |        |   |   |   |   |
| 1552 |                                                                                                                                          |   |        |   |                                                              |   |        |   |   |   |   |
| 1553 | <b>General Statistics</b>                                                                                                                |   |        |   |                                                              |   |        |   |   |   |   |
| 1554 | Total Number of Observations                                                                                                             |   | 32     |   | Number of Distinct Observations                              |   | 25     |   |   |   |   |
| 1555 | Number of Detects                                                                                                                        |   | 21     |   | Number of Non-Detects                                        |   | 11     |   |   |   |   |
| 1556 | Number of Distinct Detects                                                                                                               |   | 19     |   | Number of Distinct Non-Detects                               |   | 6      |   |   |   |   |
| 1557 | Minimum Detect                                                                                                                           |   | 0.516  |   | Minimum Non-Detect                                           |   | 0.031  |   |   |   |   |
| 1558 | Maximum Detect                                                                                                                           |   | 26.5   |   | Maximum Non-Detect                                           |   | 0.075  |   |   |   |   |
| 1559 | Variance Detects                                                                                                                         |   | 37.54  |   | Percent Non-Detects                                          |   | 34.38% |   |   |   |   |
| 1560 | Mean Detects                                                                                                                             |   | 4.014  |   | SD Detects                                                   |   | 6.127  |   |   |   |   |
| 1561 | Median Detects                                                                                                                           |   | 2      |   | CV Detects                                                   |   | 1.526  |   |   |   |   |
| 1562 | Skewness Detects                                                                                                                         |   | 3.062  |   | Kurtosis Detects                                             |   | 9.713  |   |   |   |   |
| 1563 | Mean of Logged Detects                                                                                                                   |   | 0.792  |   | SD of Logged Detects                                         |   | 1.014  |   |   |   |   |
| 1564 |                                                                                                                                          |   |        |   |                                                              |   |        |   |   |   |   |
| 1565 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |        |   |                                                              |   |        |   |   |   |   |
| 1566 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.552  |   | <b>Shapiro Wilk GOF Test</b>                                 |   |        |   |   |   |   |
| 1567 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.908  |   | Detected Data Not Normal at 5% Significance Level            |   |        |   |   |   |   |
| 1568 | Lilliefors Test Statistic                                                                                                                |   | 0.371  |   | <b>Lilliefors GOF Test</b>                                   |   |        |   |   |   |   |
| 1569 | 5% Lilliefors Critical Value                                                                                                             |   | 0.188  |   | Detected Data Not Normal at 5% Significance Level            |   |        |   |   |   |   |
| 1570 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |   |        |   |                                                              |   |        |   |   |   |   |
| 1571 |                                                                                                                                          |   |        |   |                                                              |   |        |   |   |   |   |
| 1572 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |        |   |                                                              |   |        |   |   |   |   |
| 1573 | KM Mean                                                                                                                                  |   | 2.645  |   | KM Standard Error of Mean                                    |   | 0.942  |   |   |   |   |
| 1574 | KM SD                                                                                                                                    |   | 5.2    |   | 95% KM (BCA) UCL                                             |   | 4.457  |   |   |   |   |
| 1575 | 95% KM (t) UCL                                                                                                                           |   | 4.242  |   | 95% KM (Percentile Bootstrap) UCL                            |   | 4.318  |   |   |   |   |
| 1576 | 95% KM (z) UCL                                                                                                                           |   | 4.194  |   | 95% KM Bootstrap t UCL                                       |   | 7.139  |   |   |   |   |
| 1577 | 90% KM Chebyshev UCL                                                                                                                     |   | 5.471  |   | 95% KM Chebyshev UCL                                         |   | 6.751  |   |   |   |   |
| 1578 | 97.5% KM Chebyshev UCL                                                                                                                   |   | 8.528  |   | 99% KM Chebyshev UCL                                         |   | 12.02  |   |   |   |   |
| 1579 |                                                                                                                                          |   |        |   |                                                              |   |        |   |   |   |   |
| 1580 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |   |        |   |                                                              |   |        |   |   |   |   |
| 1581 | A-D Test Statistic                                                                                                                       |   | 1.242  |   | <b>Anderson-Darling GOF Test</b>                             |   |        |   |   |   |   |
| 1582 | 5% A-D Critical Value                                                                                                                    |   | 0.771  |   | Detected Data Not Gamma Distributed at 5% Significance Level |   |        |   |   |   |   |
| 1583 | K-S Test Statistic                                                                                                                       |   | 0.243  |   | <b>Kolmogorov-Smimov GOF</b>                                 |   |        |   |   |   |   |
| 1584 | 5% K-S Critical Value                                                                                                                    |   | 0.195  |   | Detected Data Not Gamma Distributed at 5% Significance Level |   |        |   |   |   |   |
| 1585 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                                      |   |        |   |                                                              |   |        |   |   |   |   |
| 1586 |                                                                                                                                          |   |        |   |                                                              |   |        |   |   |   |   |
| 1587 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |   |        |   |                                                              |   |        |   |   |   |   |
| 1588 | k hat (MLE)                                                                                                                              |   | 0.969  |   | k star (bias corrected MLE)                                  |   | 0.862  |   |   |   |   |
| 1589 | Theta hat (MLE)                                                                                                                          |   | 4.142  |   | Theta star (bias corrected MLE)                              |   | 4.655  |   |   |   |   |
| 1590 | nu hat (MLE)                                                                                                                             |   | 40.7   |   | nu star (bias corrected)                                     |   | 36.22  |   |   |   |   |
| 1591 | Mean (detects)                                                                                                                           |   | 4.014  |   |                                                              |   |        |   |   |   |   |
| 1592 |                                                                                                                                          |   |        |   |                                                              |   |        |   |   |   |   |
| 1593 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |   |        |   |                                                              |   |        |   |   |   |   |
| 1594 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |   |        |   |                                                              |   |        |   |   |   |   |
| 1595 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |   |        |   |                                                              |   |        |   |   |   |   |
| 1596 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |   |        |   |                                                              |   |        |   |   |   |   |
| 1597 | This is especially true when the sample size is small.                                                                                   |   |        |   |                                                              |   |        |   |   |   |   |
| 1598 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |   |        |   |                                                              |   |        |   |   |   |   |
| 1599 | Minimum                                                                                                                                  |   | 0.01   |   | Mean                                                         |   | 2.638  |   |   |   |   |
| 1600 | Maximum                                                                                                                                  |   | 26.5   |   | Median                                                       |   | 1.1    |   |   |   |   |
| 1601 | SD                                                                                                                                       |   | 5.287  |   | CV                                                           |   | 2.004  |   |   |   |   |
| 1602 | k hat (MLE)                                                                                                                              |   | 0.333  |   | k star (bias corrected MLE)                                  |   | 0.323  |   |   |   |   |
| 1603 | Theta hat (MLE)                                                                                                                          |   | 7.913  |   | Theta star (bias corrected MLE)                              |   | 8.168  |   |   |   |   |
| 1604 | nu hat (MLE)                                                                                                                             |   | 21.34  |   | nu star (bias corrected)                                     |   | 20.67  |   |   |   |   |
| 1605 | Adjusted Level of Significance ( $\beta$ )                                                                                               |   | 0.0416 |   |                                                              |   |        |   |   |   |   |
| 1606 | Approximate Chi Square Value (20.67, $\alpha$ )                                                                                          |   | 11.35  |   | Adjusted Chi Square Value (20.67, $\beta$ )                  |   | 10.98  |   |   |   |   |
| 1607 | 95% Gamma Approximate UCL (use when n>=50)                                                                                               |   | 4.806  |   | 95% Gamma Adjusted UCL (use when n<50)                       |   | 4.968  |   |   |   |   |
| 1608 |                                                                                                                                          |   |        |   |                                                              |   |        |   |   |   |   |

|      | A                                                                                                                                        | B | C | D      | E                                                       | F | G                           | H       | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|---------------------------------------------------------|---|-----------------------------|---------|---|---|---|---|
| 1609 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1610 | Mean (KM)                                                                                                                                |   |   | 2.645  | SD (KM)                                                 |   |                             | 5.2     |   |   |   |   |
| 1611 | Variance (KM)                                                                                                                            |   |   | 27.04  | SE of Mean (KM)                                         |   |                             | 0.942   |   |   |   |   |
| 1612 | k hat (KM)                                                                                                                               |   |   | 0.259  | k star (KM)                                             |   |                             | 0.255   |   |   |   |   |
| 1613 | nu hat (KM)                                                                                                                              |   |   | 16.56  | nu star (KM)                                            |   |                             | 16.34   |   |   |   |   |
| 1614 | theta hat (KM)                                                                                                                           |   |   | 10.22  | theta star (KM)                                         |   |                             | 10.36   |   |   |   |   |
| 1615 | 80% gamma percentile (KM)                                                                                                                |   |   | 3.87   | 90% gamma percentile (KM)                               |   |                             | 7.927   |   |   |   |   |
| 1616 | 95% gamma percentile (KM)                                                                                                                |   |   | 12.72  | 99% gamma percentile (KM)                               |   |                             | 25.45   |   |   |   |   |
| 1617 |                                                                                                                                          |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1618 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1619 | Approximate Chi Square Value (16.34, $\alpha$ )                                                                                          |   |   | 8.202  | Adjusted Chi Square Value (16.34, $\beta$ )             |   |                             | 7.894   |   |   |   |   |
| 1620 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                      |   |   | 5.269  | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )          |   |                             | 5.475   |   |   |   |   |
| 1621 |                                                                                                                                          |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1622 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1623 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.941  | <b>Shapiro Wilk GOF Test</b>                            |   |                             |         |   |   |   |   |
| 1624 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.908  | Detected Data appear Lognormal at 5% Significance Level |   |                             |         |   |   |   |   |
| 1625 | Lilliefors Test Statistic                                                                                                                |   |   | 0.153  | <b>Lilliefors GOF Test</b>                              |   |                             |         |   |   |   |   |
| 1626 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.188  | Detected Data appear Lognormal at 5% Significance Level |   |                             |         |   |   |   |   |
| 1627 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                           |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1628 |                                                                                                                                          |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1629 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1630 | Mean in Original Scale                                                                                                                   |   |   | 2.705  | Mean in Log Scale                                       |   |                             | -0.0454 |   |   |   |   |
| 1631 | SD in Original Scale                                                                                                                     |   |   | 5.253  | SD in Log Scale                                         |   |                             | 1.447   |   |   |   |   |
| 1632 | 95% t UCL (assumes normality of ROS data)                                                                                                |   |   | 4.28   | 95% Percentile Bootstrap UCL                            |   |                             | 4.405   |   |   |   |   |
| 1633 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 4.985  | 95% Bootstrap t UCL                                     |   |                             | 7.403   |   |   |   |   |
| 1634 | 95% H-UCL (Log ROS)                                                                                                                      |   |   | 5.963  |                                                         |   |                             |         |   |   |   |   |
| 1635 |                                                                                                                                          |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1636 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1637 | KM Mean (logged)                                                                                                                         |   |   | -0.674 | KM Geo Mean                                             |   |                             | 0.509   |   |   |   |   |
| 1638 | KM SD (logged)                                                                                                                           |   |   | 2.179  | 95% Critical H Value (KM-Log)                           |   |                             | 4.107   |   |   |   |   |
| 1639 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.395  | 95% H-UCL (KM -Log)                                     |   |                             | 27.29   |   |   |   |   |
| 1640 | KM SD (logged)                                                                                                                           |   |   | 2.179  | 95% Critical H Value (KM-Log)                           |   |                             | 4.107   |   |   |   |   |
| 1641 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.395  |                                                         |   |                             |         |   |   |   |   |
| 1642 |                                                                                                                                          |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1643 | <b>DL/2 Statistics</b>                                                                                                                   |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1644 | <b>DL/2 Normal</b>                                                                                                                       |   |   |        |                                                         |   | <b>DL/2 Log-Transformed</b> |         |   |   |   |   |
| 1645 | Mean in Original Scale                                                                                                                   |   |   | 2.641  | Mean in Log Scale                                       |   |                             | -0.864  |   |   |   |   |
| 1646 | SD in Original Scale                                                                                                                     |   |   | 5.286  | SD in Log Scale                                         |   |                             | 2.467   |   |   |   |   |
| 1647 | 95% t UCL (Assumes normality)                                                                                                            |   |   | 4.225  | 95% H-Stat UCL                                          |   |                             | 66.77   |   |   |   |   |
| 1648 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1649 |                                                                                                                                          |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1650 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1651 | <b>Detected Data appear Lognormal Distributed at 5% Significance Level</b>                                                               |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1652 |                                                                                                                                          |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1653 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1654 | KM H-UCL                                                                                                                                 |   |   | 27.29  |                                                         |   |                             |         |   |   |   |   |
| 1655 |                                                                                                                                          |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1656 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1657 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1658 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1659 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1660 |                                                                                                                                          |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1661 | <b>Result (eu2_antimony_waste rock)</b>                                                                                                  |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1662 |                                                                                                                                          |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1663 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1664 | Total Number of Observations                                                                                                             |   |   | 53     | Number of Distinct Observations                         |   |                             | 46      |   |   |   |   |
| 1665 | Number of Detects                                                                                                                        |   |   | 47     | Number of Non-Detects                                   |   |                             | 6       |   |   |   |   |
| 1666 | Number of Distinct Detects                                                                                                               |   |   | 41     | Number of Distinct Non-Detects                          |   |                             | 5       |   |   |   |   |
| 1667 | Minimum Detect                                                                                                                           |   |   | 1.4    | Minimum Non-Detect                                      |   |                             | 0.494   |   |   |   |   |
| 1668 | Maximum Detect                                                                                                                           |   |   | 62.9   | Maximum Non-Detect                                      |   |                             | 1.2     |   |   |   |   |
| 1669 | Variance Detects                                                                                                                         |   |   | 147.2  | Percent Non-Detects                                     |   |                             | 11.32%  |   |   |   |   |
| 1670 | Mean Detects                                                                                                                             |   |   | 15.97  | SD Detects                                              |   |                             | 12.13   |   |   |   |   |
| 1671 | Median Detects                                                                                                                           |   |   | 12.5   | CV Detects                                              |   |                             | 0.76    |   |   |   |   |
| 1672 | Skewness Detects                                                                                                                         |   |   | 1.755  | Kurtosis Detects                                        |   |                             | 4.134   |   |   |   |   |
| 1673 | Mean of Logged Detects                                                                                                                   |   |   | 2.495  | SD of Logged Detects                                    |   |                             | 0.799   |   |   |   |   |
| 1674 |                                                                                                                                          |   |   |        |                                                         |   |                             |         |   |   |   |   |
| 1675 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |   |        |                                                         |   |                             |         |   |   |   |   |

|      | A                                                                                                                         | B | C | D      | E                                                               | F | G | H     | I | J | K | L |  |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------------------|---|---|-------|---|---|---|---|--|
| 1676 | Shapiro Wilk Test Statistic                                                                                               |   |   | 0.855  | <b>Shapiro Wilk GOF Test</b>                                    |   |   |       |   |   |   |   |  |
| 1677 | 5% Shapiro Wilk Critical Value                                                                                            |   |   | 0.946  | Detected Data Not Normal at 5% Significance Level               |   |   |       |   |   |   |   |  |
| 1678 | Lilliefors Test Statistic                                                                                                 |   |   | 0.16   | <b>Lilliefors GOF Test</b>                                      |   |   |       |   |   |   |   |  |
| 1679 | 5% Lilliefors Critical Value                                                                                              |   |   | 0.128  | Detected Data Not Normal at 5% Significance Level               |   |   |       |   |   |   |   |  |
| 1680 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1681 |                                                                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1682 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1683 | KM Mean                                                                                                                   |   |   | 14.22  | KM Standard Error of Mean                                       |   |   | 1.711 |   |   |   |   |  |
| 1684 | KM SD                                                                                                                     |   |   | 12.32  | 95% KM (BCA) UCL                                                |   |   | 17.13 |   |   |   |   |  |
| 1685 | 95% KM (t) UCL                                                                                                            |   |   | 17.08  | 95% KM (Percentile Bootstrap) UCL                               |   |   | 17    |   |   |   |   |  |
| 1686 | 95% KM (z) UCL                                                                                                            |   |   | 17.03  | 95% KM Bootstrap t UCL                                          |   |   | 17.72 |   |   |   |   |  |
| 1687 | 90% KM Chebyshev UCL                                                                                                      |   |   | 19.35  | 95% KM Chebyshev UCL                                            |   |   | 21.68 |   |   |   |   |  |
| 1688 | 97.5% KM Chebyshev UCL                                                                                                    |   |   | 24.9   | 99% KM Chebyshev UCL                                            |   |   | 31.24 |   |   |   |   |  |
| 1689 |                                                                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1690 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1691 | A-D Test Statistic                                                                                                        |   |   | 0.255  | <b>Anderson-Darling GOF Test</b>                                |   |   |       |   |   |   |   |  |
| 1692 | 5% A-D Critical Value                                                                                                     |   |   | 0.762  | detected data appear Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |   |  |
| 1693 | K-S Test Statistic                                                                                                        |   |   | 0.0792 | <b>Kolmogorov-Smirnov GOF</b>                                   |   |   |       |   |   |   |   |  |
| 1694 | 5% K-S Critical Value                                                                                                     |   |   | 0.131  | detected data appear Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |   |  |
| 1695 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                    |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1696 |                                                                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1697 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1698 | k hat (MLE)                                                                                                               |   |   | 1.962  | k star (bias corrected MLE)                                     |   |   | 1.851 |   |   |   |   |  |
| 1699 | Theta hat (MLE)                                                                                                           |   |   | 8.139  | Theta star (bias corrected MLE)                                 |   |   | 8.627 |   |   |   |   |  |
| 1700 | nu hat (MLE)                                                                                                              |   |   | 184.5  | nu star (bias corrected)                                        |   |   | 174   |   |   |   |   |  |
| 1701 | Mean (detects)                                                                                                            |   |   | 15.97  |                                                                 |   |   |       |   |   |   |   |  |
| 1702 |                                                                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1703 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1704 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1705 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1706 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1707 | This is especially true when the sample size is small.                                                                    |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1708 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1709 | Minimum                                                                                                                   |   |   | 0.01   | Mean                                                            |   |   | 14.17 |   |   |   |   |  |
| 1710 | Maximum                                                                                                                   |   |   | 62.9   | Median                                                          |   |   | 11    |   |   |   |   |  |
| 1711 | SD                                                                                                                        |   |   | 12.5   | CV                                                              |   |   | 0.882 |   |   |   |   |  |
| 1712 | k hat (MLE)                                                                                                               |   |   | 0.638  | k star (bias corrected MLE)                                     |   |   | 0.615 |   |   |   |   |  |
| 1713 | Theta hat (MLE)                                                                                                           |   |   | 22.2   | Theta star (bias corrected MLE)                                 |   |   | 23.05 |   |   |   |   |  |
| 1714 | nu hat (MLE)                                                                                                              |   |   | 67.64  | nu star (bias corrected)                                        |   |   | 65.14 |   |   |   |   |  |
| 1715 | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   | 0.0455 |                                                                 |   |   |       |   |   |   |   |  |
| 1716 | Approximate Chi Square Value (65.14, $\alpha$ )                                                                           |   |   | 47.57  | Adjusted Chi Square Value (65.14, $\beta$ )                     |   |   | 47.15 |   |   |   |   |  |
| 1717 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   | 19.4   | 95% Gamma Adjusted UCL (use when $n < 50$ )                     |   |   | 19.57 |   |   |   |   |  |
| 1718 |                                                                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1719 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1720 | Mean (KM)                                                                                                                 |   |   | 14.22  | SD (KM)                                                         |   |   | 12.32 |   |   |   |   |  |
| 1721 | Variance (KM)                                                                                                             |   |   | 151.8  | SE of Mean (KM)                                                 |   |   | 1.711 |   |   |   |   |  |
| 1722 | k hat (KM)                                                                                                                |   |   | 1.332  | k star (KM)                                                     |   |   | 1.269 |   |   |   |   |  |
| 1723 | nu hat (KM)                                                                                                               |   |   | 141.2  | nu star (KM)                                                    |   |   | 134.6 |   |   |   |   |  |
| 1724 | theta hat (KM)                                                                                                            |   |   | 10.67  | theta star (KM)                                                 |   |   | 11.2  |   |   |   |   |  |
| 1725 | 80% gamma percentile (KM)                                                                                                 |   |   | 22.39  | 90% gamma percentile (KM)                                       |   |   | 30.87 |   |   |   |   |  |
| 1726 | 95% gamma percentile (KM)                                                                                                 |   |   | 39.2   | 99% gamma percentile (KM)                                       |   |   | 58.21 |   |   |   |   |  |
| 1727 |                                                                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1728 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1729 | Approximate Chi Square Value (134.56, $\alpha$ )                                                                          |   |   | 108.8  | Adjusted Chi Square Value (134.56, $\beta$ )                    |   |   | 108.1 |   |   |   |   |  |
| 1730 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   |   | 17.59  | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )                  |   |   | 17.7  |   |   |   |   |  |
| 1731 |                                                                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1732 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1733 | Shapiro Wilk Test Statistic                                                                                               |   |   | 0.972  | <b>Shapiro Wilk GOF Test</b>                                    |   |   |       |   |   |   |   |  |
| 1734 | 5% Shapiro Wilk Critical Value                                                                                            |   |   | 0.946  | Detected Data appear Lognormal at 5% Significance Level         |   |   |       |   |   |   |   |  |
| 1735 | Lilliefors Test Statistic                                                                                                 |   |   | 0.0763 | <b>Lilliefors GOF Test</b>                                      |   |   |       |   |   |   |   |  |
| 1736 | 5% Lilliefors Critical Value                                                                                              |   |   | 0.128  | Detected Data appear Lognormal at 5% Significance Level         |   |   |       |   |   |   |   |  |
| 1737 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                            |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1738 |                                                                                                                           |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1739 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 1740 | Mean in Original Scale                                                                                                    |   |   | 14.41  | Mean in Log Scale                                               |   |   | 2.298 |   |   |   |   |  |
| 1741 | SD in Original Scale                                                                                                      |   |   | 12.24  | SD in Log Scale                                                 |   |   | 0.936 |   |   |   |   |  |
| 1742 | 95% t UCL (assumes normality of ROS data)                                                                                 |   |   | 17.22  | 95% Percentile Bootstrap UCL                                    |   |   | 17.15 |   |   |   |   |  |

| A    | B                                                                                                                                         | C | D | E | F      | G                                                   | H | I | J | K     | L |
|------|-------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|--------|-----------------------------------------------------|---|---|---|-------|---|
| 1743 | 95% BCA Bootstrap UCL                                                                                                                     |   |   |   | 17.61  | 95% Bootstrap t UCL                                 |   |   |   | 18.01 |   |
| 1744 | 95% H-UCL (Log ROS)                                                                                                                       |   |   |   | 20.64  |                                                     |   |   |   |       |   |
| 1745 |                                                                                                                                           |   |   |   |        |                                                     |   |   |   |       |   |
| 1746 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                   |   |   |   |        |                                                     |   |   |   |       |   |
| 1747 | KM Mean (logged)                                                                                                                          |   |   |   | 2.133  | KM Geo Mean                                         |   |   |   | 8.437 |   |
| 1748 | KM SD (logged)                                                                                                                            |   |   |   | 1.258  | 95% Critical H Value (KM-Log)                       |   |   |   | 2.651 |   |
| 1749 | KM Standard Error of Mean (logged)                                                                                                        |   |   |   | 0.175  | 95% H-UCL (KM -Log)                                 |   |   |   | 29.55 |   |
| 1750 | KM SD (logged)                                                                                                                            |   |   |   | 1.258  | 95% Critical H Value (KM-Log)                       |   |   |   | 2.651 |   |
| 1751 | KM Standard Error of Mean (logged)                                                                                                        |   |   |   | 0.175  |                                                     |   |   |   |       |   |
| 1752 |                                                                                                                                           |   |   |   |        |                                                     |   |   |   |       |   |
| 1753 | <b>DL/2 Statistics</b>                                                                                                                    |   |   |   |        |                                                     |   |   |   |       |   |
| 1754 | <b>DL/2 Normal</b>                                                                                                                        |   |   |   |        | <b>DL/2 Log-Transformed</b>                         |   |   |   |       |   |
| 1755 | Mean in Original Scale                                                                                                                    |   |   |   | 14.2   | Mean in Log Scale                                   |   |   |   | 2.087 |   |
| 1756 | SD in Original Scale                                                                                                                      |   |   |   | 12.46  | SD in Log Scale                                     |   |   |   | 1.383 |   |
| 1757 | 95% t UCL (Assumes normality)                                                                                                             |   |   |   | 17.07  | 95% H-Stat UCL                                      |   |   |   | 35.96 |   |
| 1758 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                  |   |   |   |        |                                                     |   |   |   |       |   |
| 1759 |                                                                                                                                           |   |   |   |        |                                                     |   |   |   |       |   |
| 1760 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                     |   |   |   |        |                                                     |   |   |   |       |   |
| 1761 | <b>Detected Data appear Gamma Distributed at 5% Significance Level</b>                                                                    |   |   |   |        |                                                     |   |   |   |       |   |
| 1762 |                                                                                                                                           |   |   |   |        |                                                     |   |   |   |       |   |
| 1763 | <b>Suggested UCL to Use</b>                                                                                                               |   |   |   |        |                                                     |   |   |   |       |   |
| 1764 | 95% KM Approximate Gamma UCL                                                                                                              |   |   |   | 17.59  | 95% GROS Approximate Gamma UCL                      |   |   |   | 19.4  |   |
| 1765 |                                                                                                                                           |   |   |   |        |                                                     |   |   |   |       |   |
| 1766 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |   |   |   |        |                                                     |   |   |   |       |   |
| 1767 | Recommendations are based upon data size, data distribution, and skewness.                                                                |   |   |   |        |                                                     |   |   |   |       |   |
| 1768 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |   |   |   |        |                                                     |   |   |   |       |   |
| 1769 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |   |   |   |        |                                                     |   |   |   |       |   |
| 1770 |                                                                                                                                           |   |   |   |        |                                                     |   |   |   |       |   |
| 1771 |                                                                                                                                           |   |   |   |        |                                                     |   |   |   |       |   |
| 1772 | <b>Result (eu2_arsenic_overbank)</b>                                                                                                      |   |   |   |        |                                                     |   |   |   |       |   |
| 1773 |                                                                                                                                           |   |   |   |        |                                                     |   |   |   |       |   |
| 1774 | <b>General Statistics</b>                                                                                                                 |   |   |   |        |                                                     |   |   |   |       |   |
| 1775 | Total Number of Observations                                                                                                              |   |   |   | 34     | Number of Distinct Observations                     |   |   |   | 34    |   |
| 1776 |                                                                                                                                           |   |   |   |        | Number of Missing Observations                      |   |   |   | 0     |   |
| 1777 | Minimum                                                                                                                                   |   |   |   | 5.1    | Mean                                                |   |   |   | 34.96 |   |
| 1778 | Maximum                                                                                                                                   |   |   |   | 445    | Median                                              |   |   |   | 20.8  |   |
| 1779 | SD                                                                                                                                        |   |   |   | 73.6   | Std. Error of Mean                                  |   |   |   | 12.62 |   |
| 1780 | Coefficient of Variation                                                                                                                  |   |   |   | 2.105  | Skewness                                            |   |   |   | 5.549 |   |
| 1781 |                                                                                                                                           |   |   |   |        |                                                     |   |   |   |       |   |
| 1782 | <b>Normal GOF Test</b>                                                                                                                    |   |   |   |        |                                                     |   |   |   |       |   |
| 1783 | Shapiro Wilk Test Statistic                                                                                                               |   |   |   | 0.318  | <b>Shapiro Wilk GOF Test</b>                        |   |   |   |       |   |
| 1784 | 5% Shapiro Wilk Critical Value                                                                                                            |   |   |   | 0.933  | Data Not Normal at 5% Significance Level            |   |   |   |       |   |
| 1785 | Lilliefors Test Statistic                                                                                                                 |   |   |   | 0.384  | <b>Lilliefors GOF Test</b>                          |   |   |   |       |   |
| 1786 | 5% Lilliefors Critical Value                                                                                                              |   |   |   | 0.15   | Data Not Normal at 5% Significance Level            |   |   |   |       |   |
| 1787 | <b>Data Not Normal at 5% Significance Level</b>                                                                                           |   |   |   |        |                                                     |   |   |   |       |   |
| 1788 |                                                                                                                                           |   |   |   |        |                                                     |   |   |   |       |   |
| 1789 | <b>Assuming Normal Distribution</b>                                                                                                       |   |   |   |        |                                                     |   |   |   |       |   |
| 1790 | <b>95% Normal UCL</b>                                                                                                                     |   |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>             |   |   |   |       |   |
| 1791 | 95% Student's-t UCL                                                                                                                       |   |   |   | 56.33  | 95% Adjusted-CLT UCL (Chen-1995)                    |   |   |   | 68.56 |   |
| 1792 |                                                                                                                                           |   |   |   |        | 95% Modified-t UCL (Johnson-1978)                   |   |   |   | 58.33 |   |
| 1793 |                                                                                                                                           |   |   |   |        |                                                     |   |   |   |       |   |
| 1794 | <b>Gamma GOF Test</b>                                                                                                                     |   |   |   |        |                                                     |   |   |   |       |   |
| 1795 | A-D Test Statistic                                                                                                                        |   |   |   | 2.581  | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |   |       |   |
| 1796 | 5% A-D Critical Value                                                                                                                     |   |   |   | 0.774  | Data Not Gamma Distributed at 5% Significance Level |   |   |   |       |   |
| 1797 | K-S Test Statistic                                                                                                                        |   |   |   | 0.203  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |   |       |   |
| 1798 | 5% K-S Critical Value                                                                                                                     |   |   |   | 0.155  | Data Not Gamma Distributed at 5% Significance Level |   |   |   |       |   |
| 1799 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                                |   |   |   |        |                                                     |   |   |   |       |   |
| 1800 |                                                                                                                                           |   |   |   |        |                                                     |   |   |   |       |   |
| 1801 | <b>Gamma Statistics</b>                                                                                                                   |   |   |   |        |                                                     |   |   |   |       |   |
| 1802 | k hat (MLE)                                                                                                                               |   |   |   | 1.087  | k star (bias corrected MLE)                         |   |   |   | 1.011 |   |
| 1803 | Theta hat (MLE)                                                                                                                           |   |   |   | 32.16  | Theta star (bias corrected MLE)                     |   |   |   | 34.59 |   |
| 1804 | nu hat (MLE)                                                                                                                              |   |   |   | 73.92  | nu star (bias corrected)                            |   |   |   | 68.73 |   |
| 1805 | MLE Mean (bias corrected)                                                                                                                 |   |   |   | 34.96  | MLE Sd (bias corrected)                             |   |   |   | 34.78 |   |
| 1806 |                                                                                                                                           |   |   |   |        | Approximate Chi Square Value (0.05)                 |   |   |   | 50.65 |   |
| 1807 | Adjusted Level of Significance                                                                                                            |   |   |   | 0.0422 | Adjusted Chi Square Value                           |   |   |   | 49.88 |   |
| 1808 |                                                                                                                                           |   |   |   |        |                                                     |   |   |   |       |   |
| 1809 | <b>Assuming Gamma Distribution</b>                                                                                                        |   |   |   |        |                                                     |   |   |   |       |   |

| A    | B                                                                                                                                        | C | D     | E                                       | F                                              | G     | H | I     | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|-------|-----------------------------------------|------------------------------------------------|-------|---|-------|---|---|---|
| 1810 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |       | 47.45                                   | 95% Adjusted Gamma UCL (use when n<50)         |       |   | 48.18 |   |   |   |
| 1811 |                                                                                                                                          |   |       |                                         |                                                |       |   |       |   |   |   |
| 1812 | <b>Lognormal GOF Test</b>                                                                                                                |   |       |                                         |                                                |       |   |       |   |   |   |
| 1813 | Shapiro Wilk Test Statistic                                                                                                              |   |       | 0.909                                   | Shapiro Wilk Lognormal GOF Test                |       |   |       |   |   |   |
| 1814 | 5% Shapiro Wilk Critical Value                                                                                                           |   |       | 0.933                                   | Data Not Lognormal at 5% Significance Level    |       |   |       |   |   |   |
| 1815 | Lilliefors Test Statistic                                                                                                                |   |       | 0.108                                   | Lilliefors Lognormal GOF Test                  |       |   |       |   |   |   |
| 1816 | 5% Lilliefors Critical Value                                                                                                             |   |       | 0.15                                    | Data appear Lognormal at 5% Significance Level |       |   |       |   |   |   |
| 1817 | <b>Data appear Approximate Lognormal at 5% Significance Level</b>                                                                        |   |       |                                         |                                                |       |   |       |   |   |   |
| 1818 |                                                                                                                                          |   |       |                                         |                                                |       |   |       |   |   |   |
| 1819 | <b>Lognormal Statistics</b>                                                                                                              |   |       |                                         |                                                |       |   |       |   |   |   |
| 1820 | Minimum of Logged Data                                                                                                                   |   |       | 1.629                                   | Mean of logged Data                            |       |   | 3.028 |   |   |   |
| 1821 | Maximum of Logged Data                                                                                                                   |   |       | 6.098                                   | SD of logged Data                              |       |   | 0.827 |   |   |   |
| 1822 |                                                                                                                                          |   |       |                                         |                                                |       |   |       |   |   |   |
| 1823 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |       |                                         |                                                |       |   |       |   |   |   |
| 1824 | 95% H-UCL                                                                                                                                |   | 40.23 | 90% Chebyshev (MVUE) UCL                |                                                | 42.34 |   |       |   |   |   |
| 1825 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 48.51 | 97.5% Chebyshev (MVUE) UCL              |                                                | 57.07 |   |       |   |   |   |
| 1826 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 73.89 |                                         |                                                |       |   |       |   |   |   |
| 1827 |                                                                                                                                          |   |       |                                         |                                                |       |   |       |   |   |   |
| 1828 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |       |                                         |                                                |       |   |       |   |   |   |
| 1829 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |       |                                         |                                                |       |   |       |   |   |   |
| 1830 |                                                                                                                                          |   |       |                                         |                                                |       |   |       |   |   |   |
| 1831 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |       |                                         |                                                |       |   |       |   |   |   |
| 1832 | 95% CLT UCL                                                                                                                              |   | 55.73 | 95% Jackknife UCL                       |                                                | 56.33 |   |       |   |   |   |
| 1833 | 95% Standard Bootstrap UCL                                                                                                               |   | 55.31 | 95% Bootstrap-t UCL                     |                                                | 128.9 |   |       |   |   |   |
| 1834 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 137.3 | 95% Percentile Bootstrap UCL            |                                                | 58.94 |   |       |   |   |   |
| 1835 | 95% BCA Bootstrap UCL                                                                                                                    |   | 75.02 |                                         |                                                |       |   |       |   |   |   |
| 1836 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 72.83 | 95% Chebyshev(Mean, Sd) UCL             |                                                | 89.99 |   |       |   |   |   |
| 1837 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 113.8 | 99% Chebyshev(Mean, Sd) UCL             |                                                | 160.6 |   |       |   |   |   |
| 1838 |                                                                                                                                          |   |       |                                         |                                                |       |   |       |   |   |   |
| 1839 | <b>Suggested UCL to Use</b>                                                                                                              |   |       |                                         |                                                |       |   |       |   |   |   |
| 1840 | 95% H-UCL                                                                                                                                |   | 40.23 |                                         |                                                |       |   |       |   |   |   |
| 1841 |                                                                                                                                          |   |       |                                         |                                                |       |   |       |   |   |   |
| 1842 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |       |                                         |                                                |       |   |       |   |   |   |
| 1843 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |       |                                         |                                                |       |   |       |   |   |   |
| 1844 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |       |                                         |                                                |       |   |       |   |   |   |
| 1845 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |       |                                         |                                                |       |   |       |   |   |   |
| 1846 |                                                                                                                                          |   |       |                                         |                                                |       |   |       |   |   |   |
| 1847 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |   |       |                                         |                                                |       |   |       |   |   |   |
| 1848 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |   |       |                                         |                                                |       |   |       |   |   |   |
| 1849 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |   |       |                                         |                                                |       |   |       |   |   |   |
| 1850 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |   |       |                                         |                                                |       |   |       |   |   |   |
| 1851 |                                                                                                                                          |   |       |                                         |                                                |       |   |       |   |   |   |
| 1852 |                                                                                                                                          |   |       |                                         |                                                |       |   |       |   |   |   |
| 1853 | <b>Result (eu2_arsenic_waste rock)</b>                                                                                                   |   |       |                                         |                                                |       |   |       |   |   |   |
| 1854 |                                                                                                                                          |   |       |                                         |                                                |       |   |       |   |   |   |
| 1855 | <b>General Statistics</b>                                                                                                                |   |       |                                         |                                                |       |   |       |   |   |   |
| 1856 | Total Number of Observations                                                                                                             |   | 53    | Number of Distinct Observations         |                                                | 52    |   |       |   |   |   |
| 1857 |                                                                                                                                          |   |       | Number of Missing Observations          |                                                | 0     |   |       |   |   |   |
| 1858 | Minimum                                                                                                                                  |   | 5.5   | Mean                                    |                                                | 35.61 |   |       |   |   |   |
| 1859 | Maximum                                                                                                                                  |   | 128   | Median                                  |                                                | 34.9  |   |       |   |   |   |
| 1860 | SD                                                                                                                                       |   | 21.27 | Std. Error of Mean                      |                                                | 2.922 |   |       |   |   |   |
| 1861 | Coefficient of Variation                                                                                                                 |   | 0.597 | Skewness                                |                                                | 1.623 |   |       |   |   |   |
| 1862 |                                                                                                                                          |   |       |                                         |                                                |       |   |       |   |   |   |
| 1863 | <b>Normal GOF Test</b>                                                                                                                   |   |       |                                         |                                                |       |   |       |   |   |   |
| 1864 | Shapiro Wilk Test Statistic                                                                                                              |   |       | 0.872                                   | Shapiro Wilk GOF Test                          |       |   |       |   |   |   |
| 1865 | 5% Shapiro Wilk P Value                                                                                                                  |   |       | 6.3091E-6                               | Data Not Normal at 5% Significance Level       |       |   |       |   |   |   |
| 1866 | Lilliefors Test Statistic                                                                                                                |   |       | 0.152                                   | Lilliefors GOF Test                            |       |   |       |   |   |   |
| 1867 | 5% Lilliefors Critical Value                                                                                                             |   |       | 0.121                                   | Data Not Normal at 5% Significance Level       |       |   |       |   |   |   |
| 1868 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |       |                                         |                                                |       |   |       |   |   |   |
| 1869 |                                                                                                                                          |   |       |                                         |                                                |       |   |       |   |   |   |
| 1870 | <b>Assuming Normal Distribution</b>                                                                                                      |   |       |                                         |                                                |       |   |       |   |   |   |
| 1871 | <b>95% Normal UCL</b>                                                                                                                    |   |       | <b>95% UCLs (Adjusted for Skewness)</b> |                                                |       |   |       |   |   |   |
| 1872 | 95% Student's-t UCL                                                                                                                      |   | 40.5  | 95% Adjusted-CLT UCL (Chen-1995)        |                                                | 41.11 |   |       |   |   |   |
| 1873 |                                                                                                                                          |   |       | 95% Modified-t UCL (Johnson-1978)       |                                                | 40.61 |   |       |   |   |   |
| 1874 |                                                                                                                                          |   |       |                                         |                                                |       |   |       |   |   |   |
| 1875 | <b>Gamma GOF Test</b>                                                                                                                    |   |       |                                         |                                                |       |   |       |   |   |   |
| 1876 | A-D Test Statistic                                                                                                                       |   | 1.855 | Anderson-Darling Gamma GOF Test         |                                                |       |   |       |   |   |   |

|      | A | B | C | D                                                                                                                                        | E | F         | G | H | I | J                                           | K | L                                                   |
|------|---|---|---|------------------------------------------------------------------------------------------------------------------------------------------|---|-----------|---|---|---|---------------------------------------------|---|-----------------------------------------------------|
| 1877 |   |   |   | 5% A-D Critical Value                                                                                                                    |   | 0.759     |   |   |   |                                             |   | Data Not Gamma Distributed at 5% Significance Level |
| 1878 |   |   |   | K-S Test Statistic                                                                                                                       |   | 0.183     |   |   |   |                                             |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |
| 1879 |   |   |   | 5% K-S Critical Value                                                                                                                    |   | 0.123     |   |   |   |                                             |   | Data Not Gamma Distributed at 5% Significance Level |
| 1880 |   |   |   | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |           |   |   |   |                                             |   |                                                     |
| 1881 |   |   |   |                                                                                                                                          |   |           |   |   |   |                                             |   |                                                     |
| 1882 |   |   |   | <b>Gamma Statistics</b>                                                                                                                  |   |           |   |   |   |                                             |   |                                                     |
| 1883 |   |   |   | k hat (MLE)                                                                                                                              |   | 2.674     |   |   |   | k star (bias corrected MLE)                 |   | 2.535                                               |
| 1884 |   |   |   | Theta hat (MLE)                                                                                                                          |   | 13.32     |   |   |   | Theta star (bias corrected MLE)             |   | 14.05                                               |
| 1885 |   |   |   | nu hat (MLE)                                                                                                                             |   | 283.4     |   |   |   | nu star (bias corrected)                    |   | 268.7                                               |
| 1886 |   |   |   | MLE Mean (bias corrected)                                                                                                                |   | 35.61     |   |   |   | MLE Sd (bias corrected)                     |   | 22.37                                               |
| 1887 |   |   |   |                                                                                                                                          |   |           |   |   |   | Approximate Chi Square Value (0.05)         |   | 231.8                                               |
| 1888 |   |   |   | Adjusted Level of Significance                                                                                                           |   | 0.0455    |   |   |   | Adjusted Chi Square Value                   |   | 230.8                                               |
| 1889 |   |   |   |                                                                                                                                          |   |           |   |   |   |                                             |   |                                                     |
| 1890 |   |   |   | <b>Assuming Gamma Distribution</b>                                                                                                       |   |           |   |   |   |                                             |   |                                                     |
| 1891 |   |   |   | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   | 41.29     |   |   |   | 95% Adjusted Gamma UCL (use when n<50)      |   | 41.46                                               |
| 1892 |   |   |   |                                                                                                                                          |   |           |   |   |   |                                             |   |                                                     |
| 1893 |   |   |   | <b>Lognormal GOF Test</b>                                                                                                                |   |           |   |   |   |                                             |   |                                                     |
| 1894 |   |   |   | Shapiro Wilk Test Statistic                                                                                                              |   | 0.887     |   |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>      |   |                                                     |
| 1895 |   |   |   | 5% Shapiro Wilk P Value                                                                                                                  |   | 3.2085E-5 |   |   |   | Data Not Lognormal at 5% Significance Level |   |                                                     |
| 1896 |   |   |   | Lilliefors Test Statistic                                                                                                                |   | 0.227     |   |   |   | <b>Lilliefors Lognormal GOF Test</b>        |   |                                                     |
| 1897 |   |   |   | 5% Lilliefors Critical Value                                                                                                             |   | 0.121     |   |   |   | Data Not Lognormal at 5% Significance Level |   |                                                     |
| 1898 |   |   |   | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |   |           |   |   |   |                                             |   |                                                     |
| 1899 |   |   |   |                                                                                                                                          |   |           |   |   |   |                                             |   |                                                     |
| 1900 |   |   |   | <b>Lognormal Statistics</b>                                                                                                              |   |           |   |   |   |                                             |   |                                                     |
| 1901 |   |   |   | Minimum of Logged Data                                                                                                                   |   | 1.705     |   |   |   | Mean of logged Data                         |   | 3.374                                               |
| 1902 |   |   |   | Maximum of Logged Data                                                                                                                   |   | 4.852     |   |   |   | SD of logged Data                           |   | 0.697                                               |
| 1903 |   |   |   |                                                                                                                                          |   |           |   |   |   |                                             |   |                                                     |
| 1904 |   |   |   | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |           |   |   |   |                                             |   |                                                     |
| 1905 |   |   |   | 95% H-UCL                                                                                                                                |   | 45.29     |   |   |   | 90% Chebyshev (MVUE) UCL                    |   | 48.67                                               |
| 1906 |   |   |   | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 53.94     |   |   |   | 97.5% Chebyshev (MVUE) UCL                  |   | 61.26                                               |
| 1907 |   |   |   | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 75.64     |   |   |   |                                             |   |                                                     |
| 1908 |   |   |   |                                                                                                                                          |   |           |   |   |   |                                             |   |                                                     |
| 1909 |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |           |   |   |   |                                             |   |                                                     |
| 1910 |   |   |   | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |   |           |   |   |   |                                             |   |                                                     |
| 1911 |   |   |   |                                                                                                                                          |   |           |   |   |   |                                             |   |                                                     |
| 1912 |   |   |   | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |           |   |   |   |                                             |   |                                                     |
| 1913 |   |   |   | 95% CLT UCL                                                                                                                              |   | 40.42     |   |   |   | 95% Jackknife UCL                           |   | 40.5                                                |
| 1914 |   |   |   | 95% Standard Bootstrap UCL                                                                                                               |   | 40.43     |   |   |   | 95% Bootstrap-t UCL                         |   | 41.18                                               |
| 1915 |   |   |   | 95% Hall's Bootstrap UCL                                                                                                                 |   | 41.54     |   |   |   | 95% Percentile Bootstrap UCL                |   | 40.48                                               |
| 1916 |   |   |   | 95% BCA Bootstrap UCL                                                                                                                    |   | 40.87     |   |   |   |                                             |   |                                                     |
| 1917 |   |   |   | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 44.38     |   |   |   | 95% Chebyshev(Mean, Sd) UCL                 |   | 48.35                                               |
| 1918 |   |   |   | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 53.86     |   |   |   | 99% Chebyshev(Mean, Sd) UCL                 |   | 64.68                                               |
| 1919 |   |   |   |                                                                                                                                          |   |           |   |   |   |                                             |   |                                                     |
| 1920 |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |   |           |   |   |   |                                             |   |                                                     |
| 1921 |   |   |   | 95% Chebyshev (Mean, Sd) UCL                                                                                                             |   | 48.35     |   |   |   |                                             |   |                                                     |
| 1922 |   |   |   |                                                                                                                                          |   |           |   |   |   |                                             |   |                                                     |
| 1923 |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |           |   |   |   |                                             |   |                                                     |
| 1924 |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |           |   |   |   |                                             |   |                                                     |
| 1925 |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |           |   |   |   |                                             |   |                                                     |
| 1926 |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |           |   |   |   |                                             |   |                                                     |
| 1927 |   |   |   |                                                                                                                                          |   |           |   |   |   |                                             |   |                                                     |
| 1928 |   |   |   | <b>Result (eu2_cadmium_overbank)</b>                                                                                                     |   |           |   |   |   |                                             |   |                                                     |
| 1929 |   |   |   |                                                                                                                                          |   |           |   |   |   |                                             |   |                                                     |
| 1930 |   |   |   | <b>General Statistics</b>                                                                                                                |   |           |   |   |   |                                             |   |                                                     |
| 1931 |   |   |   | Total Number of Observations                                                                                                             |   | 34        |   |   |   | Number of Distinct Observations             |   | 32                                                  |
| 1932 |   |   |   | Number of Detects                                                                                                                        |   | 30        |   |   |   | Number of Non-Detects                       |   | 4                                                   |
| 1933 |   |   |   | Number of Distinct Detects                                                                                                               |   | 28        |   |   |   | Number of Distinct Non-Detects              |   | 4                                                   |
| 1934 |   |   |   | Minimum Detect                                                                                                                           |   | 0.55      |   |   |   | Minimum Non-Detect                          |   | 0.044                                               |
| 1935 |   |   |   | Maximum Detect                                                                                                                           |   | 20.8      |   |   |   | Maximum Non-Detect                          |   | 0.1                                                 |
| 1936 |   |   |   | Variance Detects                                                                                                                         |   | 34.31     |   |   |   | Percent Non-Detects                         |   | 11.76%                                              |
| 1937 |   |   |   | Mean Detects                                                                                                                             |   | 6.348     |   |   |   | SD Detects                                  |   | 5.858                                               |
| 1938 |   |   |   | Median Detects                                                                                                                           |   | 4.1       |   |   |   | CV Detects                                  |   | 0.923                                               |
| 1939 |   |   |   | Skewness Detects                                                                                                                         |   | 1.016     |   |   |   | Kurtosis Detects                            |   | 0.29                                                |
| 1940 |   |   |   | Mean of Logged Detects                                                                                                                   |   | 1.326     |   |   |   | SD of Logged Detects                        |   | 1.133                                               |
| 1941 |   |   |   |                                                                                                                                          |   |           |   |   |   |                                             |   |                                                     |
| 1942 |   |   |   | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |           |   |   |   |                                             |   |                                                     |
| 1943 |   |   |   | Shapiro Wilk Test Statistic                                                                                                              |   | 0.855     |   |   |   | <b>Shapiro Wilk GOF Test</b>                |   |                                                     |

|      | A                                                                                                                         | B | C      | D                                                               | E                                 | F                                                 | G | H     | I | J | K | L |
|------|---------------------------------------------------------------------------------------------------------------------------|---|--------|-----------------------------------------------------------------|-----------------------------------|---------------------------------------------------|---|-------|---|---|---|---|
| 1944 | 5% Shapiro Wilk Critical Value                                                                                            |   |        |                                                                 | 0.927                             | Detected Data Not Normal at 5% Significance Level |   |       |   |   |   |   |
| 1945 | Lilliefors Test Statistic                                                                                                 |   |        |                                                                 | 0.211                             | <b>Lilliefors GOF Test</b>                        |   |       |   |   |   |   |
| 1946 | 5% Lilliefors Critical Value                                                                                              |   |        |                                                                 | 0.159                             | Detected Data Not Normal at 5% Significance Level |   |       |   |   |   |   |
| 1947 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                  |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 1948 |                                                                                                                           |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 1949 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 1950 | KM Mean                                                                                                                   |   |        | 5.606                                                           | KM Standard Error of Mean         |                                                   |   | 1.008 |   |   |   |   |
| 1951 | KM SD                                                                                                                     |   |        | 5.778                                                           | 95% KM (BCA) UCL                  |                                                   |   | 7.272 |   |   |   |   |
| 1952 | 95% KM (t) UCL                                                                                                            |   |        | 7.312                                                           | 95% KM (Percentile Bootstrap) UCL |                                                   |   | 7.307 |   |   |   |   |
| 1953 | 95% KM (z) UCL                                                                                                            |   |        | 7.264                                                           | 95% KM Bootstrap t UCL            |                                                   |   | 7.611 |   |   |   |   |
| 1954 | 90% KM Chebyshev UCL                                                                                                      |   |        | 8.63                                                            | 95% KM Chebyshev UCL              |                                                   |   | 10    |   |   |   |   |
| 1955 | 97.5% KM Chebyshev UCL                                                                                                    |   |        | 11.9                                                            | 99% KM Chebyshev UCL              |                                                   |   | 15.63 |   |   |   |   |
| 1956 |                                                                                                                           |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 1957 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 1958 | A-D Test Statistic                                                                                                        |   | 0.695  | <b>Anderson-Darling GOF Test</b>                                |                                   |                                                   |   |       |   |   |   |   |
| 1959 | 5% A-D Critical Value                                                                                                     |   | 0.773  | detected data appear Gamma Distributed at 5% Significance Level |                                   |                                                   |   |       |   |   |   |   |
| 1960 | K-S Test Statistic                                                                                                        |   | 0.16   | <b>Kolmogorov-Smirnov GOF</b>                                   |                                   |                                                   |   |       |   |   |   |   |
| 1961 | 5% K-S Critical Value                                                                                                     |   | 0.164  | detected data appear Gamma Distributed at 5% Significance Level |                                   |                                                   |   |       |   |   |   |   |
| 1962 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                    |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 1963 |                                                                                                                           |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 1964 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 1965 | k hat (MLE)                                                                                                               |   | 1.095  | k star (bias corrected MLE)                                     |                                   | 1.008                                             |   |       |   |   |   |   |
| 1966 | Theta hat (MLE)                                                                                                           |   | 5.798  | Theta star (bias corrected MLE)                                 |                                   | 6.3                                               |   |       |   |   |   |   |
| 1967 | nu hat (MLE)                                                                                                              |   | 65.69  | nu star (bias corrected)                                        |                                   | 60.46                                             |   |       |   |   |   |   |
| 1968 | Mean (detects)                                                                                                            |   | 6.348  |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 1969 |                                                                                                                           |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 1970 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 1971 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 1972 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 1973 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 1974 | This is especially true when the sample size is small.                                                                    |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 1975 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 1976 | Minimum                                                                                                                   |   | 0.01   | Mean                                                            |                                   | 5.602                                             |   |       |   |   |   |   |
| 1977 | Maximum                                                                                                                   |   | 20.8   | Median                                                          |                                   | 2.5                                               |   |       |   |   |   |   |
| 1978 | SD                                                                                                                        |   | 5.869  | CV                                                              |                                   | 1.048                                             |   |       |   |   |   |   |
| 1979 | k hat (MLE)                                                                                                               |   | 0.569  | k star (bias corrected MLE)                                     |                                   | 0.538                                             |   |       |   |   |   |   |
| 1980 | Theta hat (MLE)                                                                                                           |   | 9.846  | Theta star (bias corrected MLE)                                 |                                   | 10.41                                             |   |       |   |   |   |   |
| 1981 | nu hat (MLE)                                                                                                              |   | 38.69  | nu star (bias corrected)                                        |                                   | 36.61                                             |   |       |   |   |   |   |
| 1982 | Adjusted Level of Significance ( $\beta$ )                                                                                |   | 0.0422 |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 1983 | Approximate Chi Square Value (36.61, $\alpha$ )                                                                           |   | 23.76  | Adjusted Chi Square Value (36.61, $\beta$ )                     |                                   | 23.25                                             |   |       |   |   |   |   |
| 1984 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   | 8.632  | 95% Gamma Adjusted UCL (use when $n < 50$ )                     |                                   | 8.822                                             |   |       |   |   |   |   |
| 1985 |                                                                                                                           |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 1986 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 1987 | Mean (KM)                                                                                                                 |   | 5.606  | SD (KM)                                                         |                                   | 5.778                                             |   |       |   |   |   |   |
| 1988 | Variance (KM)                                                                                                             |   | 33.39  | SE of Mean (KM)                                                 |                                   | 1.008                                             |   |       |   |   |   |   |
| 1989 | k hat (KM)                                                                                                                |   | 0.941  | k star (KM)                                                     |                                   | 0.878                                             |   |       |   |   |   |   |
| 1990 | nu hat (KM)                                                                                                               |   | 64     | nu star (KM)                                                    |                                   | 59.69                                             |   |       |   |   |   |   |
| 1991 | theta hat (KM)                                                                                                            |   | 5.956  | theta star (KM)                                                 |                                   | 6.387                                             |   |       |   |   |   |   |
| 1992 | 80% gamma percentile (KM)                                                                                                 |   | 9.11   | 90% gamma percentile (KM)                                       |                                   | 13.33                                             |   |       |   |   |   |   |
| 1993 | 95% gamma percentile (KM)                                                                                                 |   | 17.59  | 99% gamma percentile (KM)                                       |                                   | 27.59                                             |   |       |   |   |   |   |
| 1994 |                                                                                                                           |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 1995 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 1996 | Approximate Chi Square Value (59.69, $\alpha$ )                                                                           |   | 42.92  | Adjusted Chi Square Value (59.69, $\beta$ )                     |                                   | 42.22                                             |   |       |   |   |   |   |
| 1997 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   | 7.796  | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )                  |                                   | 7.926                                             |   |       |   |   |   |   |
| 1998 |                                                                                                                           |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 1999 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 2000 | Shapiro Wilk Test Statistic                                                                                               |   | 0.925  | <b>Shapiro Wilk GOF Test</b>                                    |                                   |                                                   |   |       |   |   |   |   |
| 2001 | 5% Shapiro Wilk Critical Value                                                                                            |   | 0.927  | Detected Data Not Lognormal at 5% Significance Level            |                                   |                                                   |   |       |   |   |   |   |
| 2002 | Lilliefors Test Statistic                                                                                                 |   | 0.149  | <b>Lilliefors GOF Test</b>                                      |                                   |                                                   |   |       |   |   |   |   |
| 2003 | 5% Lilliefors Critical Value                                                                                              |   | 0.159  | Detected Data appear Lognormal at 5% Significance Level         |                                   |                                                   |   |       |   |   |   |   |
| 2004 | <b>Detected Data appear Approximate Lognormal at 5% Significance Level</b>                                                |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 2005 |                                                                                                                           |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 2006 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |   |        |                                                                 |                                   |                                                   |   |       |   |   |   |   |
| 2007 | Mean in Original Scale                                                                                                    |   | 5.637  | Mean in Log Scale                                               |                                   | 1.031                                             |   |       |   |   |   |   |
| 2008 | SD in Original Scale                                                                                                      |   | 5.836  | SD in Log Scale                                                 |                                   | 1.343                                             |   |       |   |   |   |   |
| 2009 | 95% t UCL (assumes normality of ROS data)                                                                                 |   | 7.331  | 95% Percentile Bootstrap UCL                                    |                                   | 7.298                                             |   |       |   |   |   |   |
| 2010 | 95% BCA Bootstrap UCL                                                                                                     |   | 7.515  | 95% Bootstrap t UCL                                             |                                   | 7.65                                              |   |       |   |   |   |   |

| A    | B                                                                                                                                        | C | D | E         | F                                                   | G                           | H | I     | J | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|-----------|-----------------------------------------------------|-----------------------------|---|-------|---|---|---|--|
| 2011 | 95% H-UCL (Log ROS)                                                                                                                      |   |   |           | 13.59                                               |                             |   |       |   |   |   |  |
| 2012 |                                                                                                                                          |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2013 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2014 | KM Mean (logged)                                                                                                                         |   |   | 0.803     | KM Geo Mean                                         |                             |   | 2.232 |   |   |   |  |
| 2015 | KM SD (logged)                                                                                                                           |   |   | 1.775     | 95% Critical H Value (KM-Log)                       |                             |   | 3.524 |   |   |   |  |
| 2016 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.31      | 95% H-UCL (KM -Log)                                 |                             |   | 32.02 |   |   |   |  |
| 2017 | KM SD (logged)                                                                                                                           |   |   | 1.775     | 95% Critical H Value (KM-Log)                       |                             |   | 3.524 |   |   |   |  |
| 2018 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.31      |                                                     |                             |   |       |   |   |   |  |
| 2019 |                                                                                                                                          |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2020 | <b>DL/2 Statistics</b>                                                                                                                   |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2021 | <b>DL/2 Normal</b>                                                                                                                       |   |   |           |                                                     | <b>DL/2 Log-Transformed</b> |   |       |   |   |   |  |
| 2022 | Mean in Original Scale                                                                                                                   |   |   | 5.604     | Mean in Log Scale                                   |                             |   | 0.75  |   |   |   |  |
| 2023 | SD in Original Scale                                                                                                                     |   |   | 5.867     | SD in Log Scale                                     |                             |   | 1.925 |   |   |   |  |
| 2024 | 95% t UCL (Assumes normality)                                                                                                            |   |   | 7.307     | 95% H-Stat UCL                                      |                             |   | 47.46 |   |   |   |  |
| 2025 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2026 |                                                                                                                                          |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2027 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2028 | <b>Detected Data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2029 |                                                                                                                                          |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2030 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2031 | 95% KM Adjusted Gamma UCL                                                                                                                |   |   | 7.926     | 95% GROS Adjusted Gamma UCL                         |                             |   | 8.822 |   |   |   |  |
| 2032 |                                                                                                                                          |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2033 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2034 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2035 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2036 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2037 |                                                                                                                                          |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2038 |                                                                                                                                          |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2039 | <b>Result (eu2_cadmium_waste rock)</b>                                                                                                   |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2040 |                                                                                                                                          |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2041 | <b>General Statistics</b>                                                                                                                |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2042 | Total Number of Observations                                                                                                             |   |   | 53        | Number of Distinct Observations                     |                             |   | 48    |   |   |   |  |
| 2043 |                                                                                                                                          |   |   |           | Number of Missing Observations                      |                             |   | 0     |   |   |   |  |
| 2044 | Minimum                                                                                                                                  |   |   | 0.86      | Mean                                                |                             |   | 13.88 |   |   |   |  |
| 2045 | Maximum                                                                                                                                  |   |   | 104       | Median                                              |                             |   | 11.8  |   |   |   |  |
| 2046 | SD                                                                                                                                       |   |   | 15.69     | Std. Error of Mean                                  |                             |   | 2.155 |   |   |   |  |
| 2047 | Coefficient of Variation                                                                                                                 |   |   | 1.13      | Skewness                                            |                             |   | 4.013 |   |   |   |  |
| 2048 |                                                                                                                                          |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2049 | <b>Normal GOF Test</b>                                                                                                                   |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2050 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.628     | <b>Shapiro Wilk GOF Test</b>                        |                             |   |       |   |   |   |  |
| 2051 | 5% Shapiro Wilk P Value                                                                                                                  |   |   | 3.331E-16 | Data Not Normal at 5% Significance Level            |                             |   |       |   |   |   |  |
| 2052 | Lilliefors Test Statistic                                                                                                                |   |   | 0.26      | <b>Lilliefors GOF Test</b>                          |                             |   |       |   |   |   |  |
| 2053 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.121     | Data Not Normal at 5% Significance Level            |                             |   |       |   |   |   |  |
| 2054 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2055 |                                                                                                                                          |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2056 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2057 | <b>95% Normal UCL</b>                                                                                                                    |   |   |           | <b>95% UCLs (Adjusted for Skewness)</b>             |                             |   |       |   |   |   |  |
| 2058 | 95% Student's-t UCL                                                                                                                      |   |   | 17.49     | 95% Adjusted-CLT UCL (Chen-1995)                    |                             |   | 18.69 |   |   |   |  |
| 2059 |                                                                                                                                          |   |   |           | 95% Modified-t UCL (Johnson-1978)                   |                             |   | 17.69 |   |   |   |  |
| 2060 |                                                                                                                                          |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2061 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2062 | A-D Test Statistic                                                                                                                       |   |   | 1.189     | <b>Anderson-Darling Gamma GOF Test</b>              |                             |   |       |   |   |   |  |
| 2063 | 5% A-D Critical Value                                                                                                                    |   |   | 0.773     | Data Not Gamma Distributed at 5% Significance Level |                             |   |       |   |   |   |  |
| 2064 | K-S Test Statistic                                                                                                                       |   |   | 0.14      | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |                             |   |       |   |   |   |  |
| 2065 | 5% K-S Critical Value                                                                                                                    |   |   | 0.125     | Data Not Gamma Distributed at 5% Significance Level |                             |   |       |   |   |   |  |
| 2066 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2067 |                                                                                                                                          |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2068 | <b>Gamma Statistics</b>                                                                                                                  |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2069 | k hat (MLE)                                                                                                                              |   |   | 1.282     | k star (bias corrected MLE)                         |                             |   | 1.222 |   |   |   |  |
| 2070 | Theta hat (MLE)                                                                                                                          |   |   | 10.82     | Theta star (bias corrected MLE)                     |                             |   | 11.36 |   |   |   |  |
| 2071 | nu hat (MLE)                                                                                                                             |   |   | 135.9     | nu star (bias corrected)                            |                             |   | 129.6 |   |   |   |  |
| 2072 | MLE Mean (bias corrected)                                                                                                                |   |   | 13.88     | MLE Sd (bias corrected)                             |                             |   | 12.55 |   |   |   |  |
| 2073 |                                                                                                                                          |   |   |           | Approximate Chi Square Value (0.05)                 |                             |   | 104.3 |   |   |   |  |
| 2074 | Adjusted Level of Significance                                                                                                           |   |   | 0.0455    | Adjusted Chi Square Value                           |                             |   | 103.6 |   |   |   |  |
| 2075 |                                                                                                                                          |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2076 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |           |                                                     |                             |   |       |   |   |   |  |
| 2077 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   |   | 17.25     | 95% Adjusted Gamma UCL (use when n<50)              |                             |   | 17.35 |   |   |   |  |

|      | A                                                                                                                                        | B | C       | D                                                               | E | F | G | H | I | J | K                                 | L |       |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---------|-----------------------------------------------------------------|---|---|---|---|---|---|-----------------------------------|---|-------|
| 2078 |                                                                                                                                          |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2079 | <b>Lognormal GOF Test</b>                                                                                                                |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2080 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.927   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |   |   |   |   |                                   |   |       |
| 2081 | 5% Shapiro Wilk P Value                                                                                                                  |   | 0.00332 | Data Not Lognormal at 5% Significance Level                     |   |   |   |   |   |   |                                   |   |       |
| 2082 | Lilliefors Test Statistic                                                                                                                |   | 0.178   | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |   |   |   |   |                                   |   |       |
| 2083 | 5% Lilliefors Critical Value                                                                                                             |   | 0.121   | Data Not Lognormal at 5% Significance Level                     |   |   |   |   |   |   |                                   |   |       |
| 2084 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2085 |                                                                                                                                          |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2086 | <b>Lognormal Statistics</b>                                                                                                              |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2087 | Minimum of Logged Data                                                                                                                   |   | -0.151  |                                                                 |   |   |   |   |   |   | Mean of logged Data               |   | 2.192 |
| 2088 | Maximum of Logged Data                                                                                                                   |   | 4.644   |                                                                 |   |   |   |   |   |   | SD of logged Data                 |   | 1.015 |
| 2089 |                                                                                                                                          |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2090 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2091 | 95% H-UCL                                                                                                                                |   | 20.82   |                                                                 |   |   |   |   |   |   | 90% Chebyshev (MVUE) UCL          |   | 22.09 |
| 2092 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 25.41   |                                                                 |   |   |   |   |   |   | 97.5% Chebyshev (MVUE) UCL        |   | 30.01 |
| 2093 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 39.04   |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2094 |                                                                                                                                          |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2095 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2096 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2097 |                                                                                                                                          |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2098 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2099 | 95% CLT UCL                                                                                                                              |   | 17.43   |                                                                 |   |   |   |   |   |   | 95% Jackknife UCL                 |   | 17.49 |
| 2100 | 95% Standard Bootstrap UCL                                                                                                               |   | 17.29   |                                                                 |   |   |   |   |   |   | 95% Bootstrap-t UCL               |   | 20.46 |
| 2101 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 33.63   |                                                                 |   |   |   |   |   |   | 95% Percentile Bootstrap UCL      |   | 17.7  |
| 2102 | 95% BCA Bootstrap UCL                                                                                                                    |   | 19.26   |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2103 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 20.35   |                                                                 |   |   |   |   |   |   | 95% Chebyshev(Mean, Sd) UCL       |   | 23.27 |
| 2104 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 27.34   |                                                                 |   |   |   |   |   |   | 99% Chebyshev(Mean, Sd) UCL       |   | 35.32 |
| 2105 |                                                                                                                                          |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2106 | <b>Suggested UCL to Use</b>                                                                                                              |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2107 | 95% Chebyshev (Mean, Sd) UCL                                                                                                             |   | 23.27   |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2108 |                                                                                                                                          |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2109 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2110 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2111 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2112 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2113 |                                                                                                                                          |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2114 |                                                                                                                                          |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2115 | <b>Result (eu2_chromium_overbank)</b>                                                                                                    |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2116 |                                                                                                                                          |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2117 | <b>General Statistics</b>                                                                                                                |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2118 | Total Number of Observations                                                                                                             |   | 34      |                                                                 |   |   |   |   |   |   | Number of Distinct Observations   |   | 30    |
| 2119 |                                                                                                                                          |   |         |                                                                 |   |   |   |   |   |   | Number of Missing Observations    |   | 0     |
| 2120 | Minimum                                                                                                                                  |   | 2.2     |                                                                 |   |   |   |   |   |   | Mean                              |   | 5.192 |
| 2121 | Maximum                                                                                                                                  |   | 9.7     |                                                                 |   |   |   |   |   |   | Median                            |   | 4.815 |
| 2122 | SD                                                                                                                                       |   | 2.073   |                                                                 |   |   |   |   |   |   | Std. Error of Mean                |   | 0.356 |
| 2123 | Coefficient of Variation                                                                                                                 |   | 0.399   |                                                                 |   |   |   |   |   |   | Skewness                          |   | 0.549 |
| 2124 |                                                                                                                                          |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2125 | <b>Normal GOF Test</b>                                                                                                                   |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2126 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.946   | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |   |   |   |                                   |   |       |
| 2127 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.933   | Data appear Normal at 5% Significance Level                     |   |   |   |   |   |   |                                   |   |       |
| 2128 | Lilliefors Test Statistic                                                                                                                |   | 0.102   | <b>Lilliefors GOF Test</b>                                      |   |   |   |   |   |   |                                   |   |       |
| 2129 | 5% Lilliefors Critical Value                                                                                                             |   | 0.15    | Data appear Normal at 5% Significance Level                     |   |   |   |   |   |   |                                   |   |       |
| 2130 | <b>Data appear Normal at 5% Significance Level</b>                                                                                       |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2131 |                                                                                                                                          |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2132 | <b>Assuming Normal Distribution</b>                                                                                                      |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2133 | <b>95% Normal UCL</b>                                                                                                                    |   |         | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |   |   |   |   |                                   |   |       |
| 2134 | 95% Student's-t UCL                                                                                                                      |   | 5.794   |                                                                 |   |   |   |   |   |   | 95% Adjusted-CLT UCL (Chen-1995)  |   | 5.812 |
| 2135 |                                                                                                                                          |   |         |                                                                 |   |   |   |   |   |   | 95% Modified-t UCL (Johnson-1978) |   | 5.799 |
| 2136 |                                                                                                                                          |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2137 | <b>Gamma GOF Test</b>                                                                                                                    |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2138 | A-D Test Statistic                                                                                                                       |   | 0.208   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |   |   |   |   |                                   |   |       |
| 2139 | 5% A-D Critical Value                                                                                                                    |   | 0.749   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |   |   |   |                                   |   |       |
| 2140 | K-S Test Statistic                                                                                                                       |   | 0.0742  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |   |   |   |   |                                   |   |       |
| 2141 | 5% K-S Critical Value                                                                                                                    |   | 0.151   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |   |   |   |                                   |   |       |
| 2142 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2143 |                                                                                                                                          |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |
| 2144 | <b>Gamma Statistics</b>                                                                                                                  |   |         |                                                                 |   |   |   |   |   |   |                                   |   |       |

|      | A | B | C | D | E                                                                                                                                        | F      | G | H | I | J | K                                                    | L      |
|------|---|---|---|---|------------------------------------------------------------------------------------------------------------------------------------------|--------|---|---|---|---|------------------------------------------------------|--------|
| 2145 |   |   |   |   | k hat (MLE)                                                                                                                              | 6.463  |   |   |   |   | k star (bias corrected MLE)                          | 5.913  |
| 2146 |   |   |   |   | Theta hat (MLE)                                                                                                                          | 0.803  |   |   |   |   | Theta star (bias corrected MLE)                      | 0.878  |
| 2147 |   |   |   |   | nu hat (MLE)                                                                                                                             | 439.5  |   |   |   |   | nu star (bias corrected)                             | 402.1  |
| 2148 |   |   |   |   | MLE Mean (bias corrected)                                                                                                                | 5.192  |   |   |   |   | MLE Sd (bias corrected)                              | 2.135  |
| 2149 |   |   |   |   |                                                                                                                                          |        |   |   |   |   | Approximate Chi Square Value (0.05)                  | 356.6  |
| 2150 |   |   |   |   | Adjusted Level of Significance                                                                                                           | 0.0422 |   |   |   |   | Adjusted Chi Square Value                            | 354.5  |
| 2151 |   |   |   |   | <b>Assuming Gamma Distribution</b>                                                                                                       |        |   |   |   |   |                                                      |        |
| 2152 |   |   |   |   | <b>Assuming Gamma Distribution</b>                                                                                                       |        |   |   |   |   |                                                      |        |
| 2153 |   |   |   |   | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | 5.854  |   |   |   |   | 95% Adjusted Gamma UCL (use when n<50)               | 5.889  |
| 2154 |   |   |   |   | <b>Lognormal GOF Test</b>                                                                                                                |        |   |   |   |   |                                                      |        |
| 2155 |   |   |   |   | <b>Lognormal GOF Test</b>                                                                                                                |        |   |   |   |   |                                                      |        |
| 2156 |   |   |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.969  |   |   |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>               |        |
| 2157 |   |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                           | 0.933  |   |   |   |   | Data appear Lognormal at 5% Significance Level       |        |
| 2158 |   |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.0756 |   |   |   |   | <b>Lilliefors Lognormal GOF Test</b>                 |        |
| 2159 |   |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.15   |   |   |   |   | Data appear Lognormal at 5% Significance Level       |        |
| 2160 |   |   |   |   | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |        |   |   |   |   |                                                      |        |
| 2161 |   |   |   |   | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |        |   |   |   |   |                                                      |        |
| 2162 |   |   |   |   | <b>Lognormal Statistics</b>                                                                                                              |        |   |   |   |   |                                                      |        |
| 2163 |   |   |   |   | Minimum of Logged Data                                                                                                                   | 0.788  |   |   |   |   | Mean of logged Data                                  | 1.568  |
| 2164 |   |   |   |   | Maximum of Logged Data                                                                                                                   | 2.272  |   |   |   |   | SD of logged Data                                    | 0.41   |
| 2165 |   |   |   |   | <b>Assuming Lognormal Distribution</b>                                                                                                   |        |   |   |   |   |                                                      |        |
| 2166 |   |   |   |   | <b>Assuming Lognormal Distribution</b>                                                                                                   |        |   |   |   |   |                                                      |        |
| 2167 |   |   |   |   | 95% H-UCL                                                                                                                                | 5.963  |   |   |   |   | 90% Chebyshev (MVUE) UCL                             | 6.335  |
| 2168 |   |   |   |   | 95% Chebyshev (MVUE) UCL                                                                                                                 | 6.849  |   |   |   |   | 97.5% Chebyshev (MVUE) UCL                           | 7.561  |
| 2169 |   |   |   |   | 99% Chebyshev (MVUE) UCL                                                                                                                 | 8.959  |   |   |   |   |                                                      |        |
| 2170 |   |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |   |   |   |   |                                                      |        |
| 2171 |   |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |   |   |   |   |                                                      |        |
| 2172 |   |   |   |   | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |        |   |   |   |   |                                                      |        |
| 2173 |   |   |   |   | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |        |   |   |   |   |                                                      |        |
| 2174 |   |   |   |   | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |        |   |   |   |   |                                                      |        |
| 2175 |   |   |   |   | 95% CLT UCL                                                                                                                              | 5.777  |   |   |   |   | 95% Jackknife UCL                                    | 5.794  |
| 2176 |   |   |   |   | 95% Standard Bootstrap UCL                                                                                                               | 5.758  |   |   |   |   | 95% Bootstrap-t UCL                                  | 5.849  |
| 2177 |   |   |   |   | 95% Hall's Bootstrap UCL                                                                                                                 | 5.847  |   |   |   |   | 95% Percentile Bootstrap UCL                         | 5.774  |
| 2178 |   |   |   |   | 95% BCA Bootstrap UCL                                                                                                                    | 5.81   |   |   |   |   |                                                      |        |
| 2179 |   |   |   |   | 90% Chebyshev(Mean, Sd) UCL                                                                                                              | 6.259  |   |   |   |   | 95% Chebyshev(Mean, Sd) UCL                          | 6.742  |
| 2180 |   |   |   |   | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            | 7.412  |   |   |   |   | 99% Chebyshev(Mean, Sd) UCL                          | 8.73   |
| 2181 |   |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |        |   |   |   |   |                                                      |        |
| 2182 |   |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |        |   |   |   |   |                                                      |        |
| 2183 |   |   |   |   | 95% Student's-t UCL                                                                                                                      | 5.794  |   |   |   |   |                                                      |        |
| 2184 |   |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |        |   |   |   |   |                                                      |        |
| 2185 |   |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |   |   |   |   |                                                      |        |
| 2186 |   |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |   |   |   |   |                                                      |        |
| 2187 |   |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |   |   |   |   |                                                      |        |
| 2188 |   |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |   |   |   |   |                                                      |        |
| 2189 |   |   |   |   |                                                                                                                                          |        |   |   |   |   |                                                      |        |
| 2190 |   |   |   |   | <b>Result (eu2_chromium_waste rock)</b>                                                                                                  |        |   |   |   |   |                                                      |        |
| 2191 |   |   |   |   |                                                                                                                                          |        |   |   |   |   |                                                      |        |
| 2192 |   |   |   |   | <b>General Statistics</b>                                                                                                                |        |   |   |   |   |                                                      |        |
| 2193 |   |   |   |   | Total Number of Observations                                                                                                             | 53     |   |   |   |   | Number of Distinct Observations                      | 38     |
| 2194 |   |   |   |   | Number of Detects                                                                                                                        | 52     |   |   |   |   | Number of Non-Detects                                | 1      |
| 2195 |   |   |   |   | Number of Distinct Detects                                                                                                               | 37     |   |   |   |   | Number of Distinct Non-Detects                       | 1      |
| 2196 |   |   |   |   | Minimum Detect                                                                                                                           | 0.65   |   |   |   |   | Minimum Non-Detect                                   | 0.16   |
| 2197 |   |   |   |   | Maximum Detect                                                                                                                           | 9.8    |   |   |   |   | Maximum Non-Detect                                   | 0.16   |
| 2198 |   |   |   |   | Variance Detects                                                                                                                         | 3.232  |   |   |   |   | Percent Non-Detects                                  | 1.887% |
| 2199 |   |   |   |   | Mean Detects                                                                                                                             | 4.792  |   |   |   |   | SD Detects                                           | 1.798  |
| 2200 |   |   |   |   | Median Detects                                                                                                                           | 4.9    |   |   |   |   | CV Detects                                           | 0.375  |
| 2201 |   |   |   |   | Skewness Detects                                                                                                                         | 0.154  |   |   |   |   | Kurtosis Detects                                     | 0.849  |
| 2202 |   |   |   |   | Mean of Logged Detects                                                                                                                   | 1.474  |   |   |   |   | SD of Logged Detects                                 | 0.489  |
| 2203 |   |   |   |   | <b>Normal GOF Test on Detects Only</b>                                                                                                   |        |   |   |   |   |                                                      |        |
| 2204 |   |   |   |   | <b>Normal GOF Test on Detects Only</b>                                                                                                   |        |   |   |   |   |                                                      |        |
| 2205 |   |   |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.968  |   |   |   |   | <b>Normal GOF Test on Detected Observations Only</b> |        |
| 2206 |   |   |   |   | 5% Shapiro Wilk P Value                                                                                                                  | 0.309  |   |   |   |   | Detected Data appear Normal at 5% Significance Level |        |
| 2207 |   |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.116  |   |   |   |   | <b>Lilliefors GOF Test</b>                           |        |
| 2208 |   |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.122  |   |   |   |   | Detected Data appear Normal at 5% Significance Level |        |
| 2209 |   |   |   |   | <b>Detected Data appear Normal at 5% Significance Level</b>                                                                              |        |   |   |   |   |                                                      |        |
| 2210 |   |   |   |   | <b>Detected Data appear Normal at 5% Significance Level</b>                                                                              |        |   |   |   |   |                                                      |        |
| 2211 |   |   |   |   | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |        |   |   |   |   |                                                      |        |

| A    | B                                                                                                                         | C | D | E                                                   | F         | G | H | I                                                            | J | K     | L |  |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|-----------------------------------------------------|-----------|---|---|--------------------------------------------------------------|---|-------|---|--|
| 2212 |                                                                                                                           |   |   | KM Mean                                             | 4.704     |   |   | KM Standard Error of Mean                                    |   | 0.26  |   |  |
| 2213 |                                                                                                                           |   |   | KM SD                                               | 1.873     |   |   | 95% KM (BCA) UCL                                             |   | 5.111 |   |  |
| 2214 |                                                                                                                           |   |   | 95% KM (t) UCL                                      | 5.139     |   |   | 95% KM (Percentile Bootstrap) UCL                            |   | 5.143 |   |  |
| 2215 |                                                                                                                           |   |   | 95% KM (z) UCL                                      | 5.132     |   |   | 95% KM Bootstrap t UCL                                       |   | 5.145 |   |  |
| 2216 |                                                                                                                           |   |   | 90% KM Chebyshev UCL                                | 5.484     |   |   | 95% KM Chebyshev UCL                                         |   | 5.837 |   |  |
| 2217 |                                                                                                                           |   |   | 97.5% KM Chebyshev UCL                              | 6.327     |   |   | 99% KM Chebyshev UCL                                         |   | 7.289 |   |  |
| 2218 |                                                                                                                           |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2219 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2220 |                                                                                                                           |   |   | A-D Test Statistic                                  | 1.658     |   |   | <b>Anderson-Darling GOF Test</b>                             |   |       |   |  |
| 2221 |                                                                                                                           |   |   | 5% A-D Critical Value                               | 0.753     |   |   | Detected Data Not Gamma Distributed at 5% Significance Level |   |       |   |  |
| 2222 |                                                                                                                           |   |   | K-S Test Statistic                                  | 0.174     |   |   | <b>Kolmogorov-Smirnov GOF</b>                                |   |       |   |  |
| 2223 |                                                                                                                           |   |   | 5% K-S Critical Value                               | 0.123     |   |   | Detected Data Not Gamma Distributed at 5% Significance Level |   |       |   |  |
| 2224 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                       |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2225 |                                                                                                                           |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2226 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2227 |                                                                                                                           |   |   | k hat (MLE)                                         | 5.54      |   |   | k star (bias corrected MLE)                                  |   | 5.233 |   |  |
| 2228 |                                                                                                                           |   |   | Theta hat (MLE)                                     | 0.865     |   |   | Theta star (bias corrected MLE)                              |   | 0.916 |   |  |
| 2229 |                                                                                                                           |   |   | nu hat (MLE)                                        | 576.2     |   |   | nu star (bias corrected)                                     |   | 544.3 |   |  |
| 2230 |                                                                                                                           |   |   | Mean (detects)                                      | 4.792     |   |   |                                                              |   |       |   |  |
| 2231 |                                                                                                                           |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2232 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2233 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2234 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2235 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2236 | This is especially true when the sample size is small.                                                                    |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2237 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2238 |                                                                                                                           |   |   | Minimum                                             | 0.65      |   |   | Mean                                                         |   | 4.73  |   |  |
| 2239 |                                                                                                                           |   |   | Maximum                                             | 9.8       |   |   | Median                                                       |   | 4.9   |   |  |
| 2240 |                                                                                                                           |   |   | SD                                                  | 1.836     |   |   | CV                                                           |   | 0.388 |   |  |
| 2241 |                                                                                                                           |   |   | k hat (MLE)                                         | 5.17      |   |   | k star (bias corrected MLE)                                  |   | 4.89  |   |  |
| 2242 |                                                                                                                           |   |   | Theta hat (MLE)                                     | 0.915     |   |   | Theta star (bias corrected MLE)                              |   | 0.967 |   |  |
| 2243 |                                                                                                                           |   |   | nu hat (MLE)                                        | 548       |   |   | nu star (bias corrected)                                     |   | 518.3 |   |  |
| 2244 |                                                                                                                           |   |   | Adjusted Level of Significance ( $\beta$ )          | 0.0455    |   |   |                                                              |   |       |   |  |
| 2245 |                                                                                                                           |   |   | Approximate Chi Square Value (518.30, $\alpha$ )    | 466.5     |   |   | Adjusted Chi Square Value (518.30, $\beta$ )                 |   | 465.1 |   |  |
| 2246 |                                                                                                                           |   |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )   | 5.255     |   |   | 95% Gamma Adjusted UCL (use when $n < 50$ )                  |   | 5.271 |   |  |
| 2247 |                                                                                                                           |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2248 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2249 |                                                                                                                           |   |   | Mean (KM)                                           | 4.704     |   |   | SD (KM)                                                      |   | 1.873 |   |  |
| 2250 |                                                                                                                           |   |   | Variance (KM)                                       | 3.507     |   |   | SE of Mean (KM)                                              |   | 0.26  |   |  |
| 2251 |                                                                                                                           |   |   | k hat (KM)                                          | 6.31      |   |   | k star (KM)                                                  |   | 5.965 |   |  |
| 2252 |                                                                                                                           |   |   | nu hat (KM)                                         | 668.8     |   |   | nu star (KM)                                                 |   | 632.3 |   |  |
| 2253 |                                                                                                                           |   |   | theta hat (KM)                                      | 0.746     |   |   | theta star (KM)                                              |   | 0.789 |   |  |
| 2254 |                                                                                                                           |   |   | 80% gamma percentile (KM)                           | 6.203     |   |   | 90% gamma percentile (KM)                                    |   | 7.279 |   |  |
| 2255 |                                                                                                                           |   |   | 95% gamma percentile (KM)                           | 8.254     |   |   | 99% gamma percentile (KM)                                    |   | 10.3  |   |  |
| 2256 |                                                                                                                           |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2257 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2258 |                                                                                                                           |   |   | Approximate Chi Square Value (632.31, $\alpha$ )    | 575       |   |   | Adjusted Chi Square Value (632.31, $\beta$ )                 |   | 573.5 |   |  |
| 2259 |                                                                                                                           |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ ) | 5.173     |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )               |   | 5.187 |   |  |
| 2260 |                                                                                                                           |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2261 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2262 |                                                                                                                           |   |   | Shapiro Wilk Approximate Test Statistic             | 0.859     |   |   | <b>Shapiro Wilk GOF Test</b>                                 |   |       |   |  |
| 2263 |                                                                                                                           |   |   | 5% Shapiro Wilk P Value                             | 1.8945E-6 |   |   | Detected Data Not Lognormal at 5% Significance Level         |   |       |   |  |
| 2264 |                                                                                                                           |   |   | Lilliefors Test Statistic                           | 0.208     |   |   | <b>Lilliefors GOF Test</b>                                   |   |       |   |  |
| 2265 |                                                                                                                           |   |   | 5% Lilliefors Critical Value                        | 0.122     |   |   | Detected Data Not Lognormal at 5% Significance Level         |   |       |   |  |
| 2266 | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                               |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2267 |                                                                                                                           |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2268 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2269 |                                                                                                                           |   |   | Mean in Original Scale                              | 4.727     |   |   | Mean in Log Scale                                            |   | 1.452 |   |  |
| 2270 |                                                                                                                           |   |   | SD in Original Scale                                | 1.841     |   |   | SD in Log Scale                                              |   | 0.51  |   |  |
| 2271 |                                                                                                                           |   |   | 95% t UCL (assumes normality of ROS data)           | 5.151     |   |   | 95% Percentile Bootstrap UCL                                 |   | 5.131 |   |  |
| 2272 |                                                                                                                           |   |   | 95% BCA Bootstrap UCL                               | 5.166     |   |   | 95% Bootstrap t UCL                                          |   | 5.161 |   |  |
| 2273 |                                                                                                                           |   |   | 95% H-UCL (Log ROS)                                 | 5.557     |   |   |                                                              |   |       |   |  |
| 2274 |                                                                                                                           |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2275 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |   |   |                                                     |           |   |   |                                                              |   |       |   |  |
| 2276 |                                                                                                                           |   |   | KM Mean (logged)                                    | 1.412     |   |   | KM Geo Mean                                                  |   | 4.102 |   |  |
| 2277 |                                                                                                                           |   |   | KM SD (logged)                                      | 0.658     |   |   | 95% Critical H Value (KM-Log)                                |   | 1.994 |   |  |
| 2278 |                                                                                                                           |   |   | KM Standard Error of Mean (logged)                  | 0.0912    |   |   | 95% H-UCL (KM -Log)                                          |   | 6.108 |   |  |

| A    | B | C | D | E | F                                                                                                                                        | G      | H | I                                       | J | K                                                               | L     |
|------|---|---|---|---|------------------------------------------------------------------------------------------------------------------------------------------|--------|---|-----------------------------------------|---|-----------------------------------------------------------------|-------|
| 2279 |   |   |   |   | KM SD (logged)                                                                                                                           | 0.658  |   |                                         |   | 95% Critical H Value (KM-Log)                                   | 1.994 |
| 2280 |   |   |   |   | KM Standard Error of Mean (logged)                                                                                                       | 0.0912 |   |                                         |   |                                                                 |       |
| 2281 |   |   |   |   |                                                                                                                                          |        |   |                                         |   |                                                                 |       |
| 2282 |   |   |   |   | <b>DL/2 Statistics</b>                                                                                                                   |        |   |                                         |   |                                                                 |       |
| 2283 |   |   |   |   | <b>DL/2 Normal</b>                                                                                                                       |        |   | <b>DL/2 Log-Transformed</b>             |   |                                                                 |       |
| 2284 |   |   |   |   | Mean in Original Scale                                                                                                                   | 4.703  |   |                                         |   | Mean in Log Scale                                               | 1.398 |
| 2285 |   |   |   |   | SD in Original Scale                                                                                                                     | 1.894  |   |                                         |   | SD in Log Scale                                                 | 0.732 |
| 2286 |   |   |   |   | 95% t UCL (Assumes normality)                                                                                                            | 5.139  |   |                                         |   | 95% H-Stat UCL                                                  | 6.523 |
| 2287 |   |   |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |        |   |                                         |   |                                                                 |       |
| 2288 |   |   |   |   |                                                                                                                                          |        |   |                                         |   |                                                                 |       |
| 2289 |   |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |   |                                         |   |                                                                 |       |
| 2290 |   |   |   |   | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                  |        |   |                                         |   |                                                                 |       |
| 2291 |   |   |   |   |                                                                                                                                          |        |   |                                         |   |                                                                 |       |
| 2292 |   |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |        |   |                                         |   |                                                                 |       |
| 2293 |   |   |   |   | 95% KM (t) UCL                                                                                                                           | 5.139  |   |                                         |   |                                                                 |       |
| 2294 |   |   |   |   |                                                                                                                                          |        |   |                                         |   |                                                                 |       |
| 2295 |   |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |   |                                         |   |                                                                 |       |
| 2296 |   |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |   |                                         |   |                                                                 |       |
| 2297 |   |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |   |                                         |   |                                                                 |       |
| 2298 |   |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |   |                                         |   |                                                                 |       |
| 2299 |   |   |   |   |                                                                                                                                          |        |   |                                         |   |                                                                 |       |
| 2300 |   |   |   |   |                                                                                                                                          |        |   |                                         |   |                                                                 |       |
| 2301 |   |   |   |   | <b>Result (eu2_cobalt_overbank)</b>                                                                                                      |        |   |                                         |   |                                                                 |       |
| 2302 |   |   |   |   |                                                                                                                                          |        |   |                                         |   |                                                                 |       |
| 2303 |   |   |   |   | <b>General Statistics</b>                                                                                                                |        |   |                                         |   |                                                                 |       |
| 2304 |   |   |   |   | Total Number of Observations                                                                                                             | 26     |   |                                         |   | Number of Distinct Observations                                 | 24    |
| 2305 |   |   |   |   |                                                                                                                                          |        |   |                                         |   | Number of Missing Observations                                  | 0     |
| 2306 |   |   |   |   | Minimum                                                                                                                                  | 4      |   |                                         |   | Mean                                                            | 11.34 |
| 2307 |   |   |   |   | Maximum                                                                                                                                  | 25.1   |   |                                         |   | Median                                                          | 10.25 |
| 2308 |   |   |   |   | SD                                                                                                                                       | 5.425  |   |                                         |   | Std. Error of Mean                                              | 1.064 |
| 2309 |   |   |   |   | Coefficient of Variation                                                                                                                 | 0.478  |   |                                         |   | Skewness                                                        | 0.849 |
| 2310 |   |   |   |   |                                                                                                                                          |        |   |                                         |   |                                                                 |       |
| 2311 |   |   |   |   | <b>Normal GOF Test</b>                                                                                                                   |        |   |                                         |   |                                                                 |       |
| 2312 |   |   |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.934  |   |                                         |   | <b>Shapiro Wilk GOF Test</b>                                    |       |
| 2313 |   |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                           | 0.92   |   |                                         |   | Data appear Normal at 5% Significance Level                     |       |
| 2314 |   |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.136  |   |                                         |   | <b>Lilliefors GOF Test</b>                                      |       |
| 2315 |   |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.17   |   |                                         |   | Data appear Normal at 5% Significance Level                     |       |
| 2316 |   |   |   |   | <b>Data appear Normal at 5% Significance Level</b>                                                                                       |        |   |                                         |   |                                                                 |       |
| 2317 |   |   |   |   |                                                                                                                                          |        |   |                                         |   |                                                                 |       |
| 2318 |   |   |   |   | <b>Assuming Normal Distribution</b>                                                                                                      |        |   |                                         |   |                                                                 |       |
| 2319 |   |   |   |   | <b>95% Normal UCL</b>                                                                                                                    |        |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |                                                                 |       |
| 2320 |   |   |   |   | 95% Student's-t UCL                                                                                                                      | 13.16  |   |                                         |   | 95% Adjusted-CLT UCL (Chen-1995)                                | 13.28 |
| 2321 |   |   |   |   |                                                                                                                                          |        |   |                                         |   | 95% Modified-t UCL (Johnson-1978)                               | 13.19 |
| 2322 |   |   |   |   |                                                                                                                                          |        |   |                                         |   |                                                                 |       |
| 2323 |   |   |   |   | <b>Gamma GOF Test</b>                                                                                                                    |        |   |                                         |   |                                                                 |       |
| 2324 |   |   |   |   | A-D Test Statistic                                                                                                                       | 0.216  |   |                                         |   | <b>Anderson-Darling Gamma GOF Test</b>                          |       |
| 2325 |   |   |   |   | 5% A-D Critical Value                                                                                                                    | 0.747  |   |                                         |   | Detected data appear Gamma Distributed at 5% Significance Level |       |
| 2326 |   |   |   |   | K-S Test Statistic                                                                                                                       | 0.0759 |   |                                         |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |       |
| 2327 |   |   |   |   | 5% K-S Critical Value                                                                                                                    | 0.172  |   |                                         |   | Detected data appear Gamma Distributed at 5% Significance Level |       |
| 2328 |   |   |   |   | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |        |   |                                         |   |                                                                 |       |
| 2329 |   |   |   |   |                                                                                                                                          |        |   |                                         |   |                                                                 |       |
| 2330 |   |   |   |   | <b>Gamma Statistics</b>                                                                                                                  |        |   |                                         |   |                                                                 |       |
| 2331 |   |   |   |   | k hat (MLE)                                                                                                                              | 4.697  |   |                                         |   | k star (bias corrected MLE)                                     | 4.181 |
| 2332 |   |   |   |   | Theta hat (MLE)                                                                                                                          | 2.414  |   |                                         |   | Theta star (bias corrected MLE)                                 | 2.712 |
| 2333 |   |   |   |   | nu hat (MLE)                                                                                                                             | 244.2  |   |                                         |   | nu star (bias corrected)                                        | 217.4 |
| 2334 |   |   |   |   | MLE Mean (bias corrected)                                                                                                                | 11.34  |   |                                         |   | MLE Sd (bias corrected)                                         | 5.545 |
| 2335 |   |   |   |   |                                                                                                                                          |        |   |                                         |   | Approximate Chi Square Value (0.05)                             | 184.3 |
| 2336 |   |   |   |   | Adjusted Level of Significance                                                                                                           | 0.0398 |   |                                         |   | Adjusted Chi Square Value                                       | 182.3 |
| 2337 |   |   |   |   |                                                                                                                                          |        |   |                                         |   |                                                                 |       |
| 2338 |   |   |   |   | <b>Assuming Gamma Distribution</b>                                                                                                       |        |   |                                         |   |                                                                 |       |
| 2339 |   |   |   |   | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | 13.38  |   |                                         |   | 95% Adjusted Gamma UCL (use when n<50)                          | 13.52 |
| 2340 |   |   |   |   |                                                                                                                                          |        |   |                                         |   |                                                                 |       |
| 2341 |   |   |   |   | <b>Lognormal GOF Test</b>                                                                                                                |        |   |                                         |   |                                                                 |       |
| 2342 |   |   |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.976  |   |                                         |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |       |
| 2343 |   |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                           | 0.92   |   |                                         |   | Data appear Lognormal at 5% Significance Level                  |       |
| 2344 |   |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.0942 |   |                                         |   | <b>Lilliefors Lognormal GOF Test</b>                            |       |
| 2345 |   |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.17   |   |                                         |   | Data appear Lognormal at 5% Significance Level                  |       |

| A    | B                                                                                                                                        | C      | D                                                            | E                                 | F      | G | H | I | J | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------------------------------------------------------|-----------------------------------|--------|---|---|---|---|---|---|--|
| 2346 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2347 |                                                                                                                                          |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2348 | <b>Lognormal Statistics</b>                                                                                                              |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2349 | Minimum of Logged Data                                                                                                                   | 1.386  |                                                              | Mean of logged Data               | 2.318  |   |   |   |   |   |   |  |
| 2350 | Maximum of Logged Data                                                                                                                   | 3.223  |                                                              | SD of logged Data                 | 0.486  |   |   |   |   |   |   |  |
| 2351 |                                                                                                                                          |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2352 | <b>Assuming Lognormal Distribution</b>                                                                                                   |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2353 | 95% H-UCL                                                                                                                                | 13.82  |                                                              | 90% Chebyshev (MVUE) UCL          | 14.75  |   |   |   |   |   |   |  |
| 2354 | 95% Chebyshev (MVUE) UCL                                                                                                                 | 16.28  |                                                              | 97.5% Chebyshev (MVUE) UCL        | 18.41  |   |   |   |   |   |   |  |
| 2355 | 99% Chebyshev (MVUE) UCL                                                                                                                 | 22.58  |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2356 |                                                                                                                                          |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2357 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2358 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2359 |                                                                                                                                          |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2360 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2361 | 95% CLT UCL                                                                                                                              | 13.09  |                                                              | 95% Jackknife UCL                 | 13.16  |   |   |   |   |   |   |  |
| 2362 | 95% Standard Bootstrap UCL                                                                                                               | 13.05  |                                                              | 95% Bootstrap-t UCL               | 13.35  |   |   |   |   |   |   |  |
| 2363 | 95% Hall's Bootstrap UCL                                                                                                                 | 13.35  |                                                              | 95% Percentile Bootstrap UCL      | 13.19  |   |   |   |   |   |   |  |
| 2364 | 95% BCA Bootstrap UCL                                                                                                                    | 13.27  |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2365 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              | 14.53  |                                                              | 95% Chebyshev(Mean, Sd) UCL       | 15.98  |   |   |   |   |   |   |  |
| 2366 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            | 17.98  |                                                              | 99% Chebyshev(Mean, Sd) UCL       | 21.92  |   |   |   |   |   |   |  |
| 2367 |                                                                                                                                          |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2368 | <b>Suggested UCL to Use</b>                                                                                                              |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2369 | 95% Student's-t UCL                                                                                                                      | 13.16  |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2370 |                                                                                                                                          |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2371 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2372 | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2373 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2374 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2375 |                                                                                                                                          |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2376 | <b>Result (eu2_cobalt_waste rock)</b>                                                                                                    |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2377 |                                                                                                                                          |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2378 | <b>General Statistics</b>                                                                                                                |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2379 | Total Number of Observations                                                                                                             | 49     |                                                              | Number of Distinct Observations   | 42     |   |   |   |   |   |   |  |
| 2380 | Number of Detects                                                                                                                        | 48     |                                                              | Number of Non-Detects             | 1      |   |   |   |   |   |   |  |
| 2381 | Number of Distinct Detects                                                                                                               | 41     |                                                              | Number of Distinct Non-Detects    | 1      |   |   |   |   |   |   |  |
| 2382 | Minimum Detect                                                                                                                           | 0.57   |                                                              | Minimum Non-Detect                | 0.9    |   |   |   |   |   |   |  |
| 2383 | Maximum Detect                                                                                                                           | 18.9   |                                                              | Maximum Non-Detect                | 0.9    |   |   |   |   |   |   |  |
| 2384 | Variance Detects                                                                                                                         | 29.08  |                                                              | Percent Non-Detects               | 2.041% |   |   |   |   |   |   |  |
| 2385 | Mean Detects                                                                                                                             | 9.431  |                                                              | SD Detects                        | 5.392  |   |   |   |   |   |   |  |
| 2386 | Median Detects                                                                                                                           | 10.6   |                                                              | CV Detects                        | 0.572  |   |   |   |   |   |   |  |
| 2387 | Skewness Detects                                                                                                                         | -0.129 |                                                              | Kurtosis Detects                  | -1.243 |   |   |   |   |   |   |  |
| 2388 | Mean of Logged Detects                                                                                                                   | 1.973  |                                                              | SD of Logged Detects              | 0.877  |   |   |   |   |   |   |  |
| 2389 |                                                                                                                                          |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2390 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2391 | Shapiro Wilk Test Statistic                                                                                                              | 0.926  |                                                              | <b>Shapiro Wilk GOF Test</b>      |        |   |   |   |   |   |   |  |
| 2392 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.947  | Detected Data Not Normal at 5% Significance Level            |                                   |        |   |   |   |   |   |   |  |
| 2393 | Lilliefors Test Statistic                                                                                                                | 0.123  |                                                              | <b>Lilliefors GOF Test</b>        |        |   |   |   |   |   |   |  |
| 2394 | 5% Lilliefors Critical Value                                                                                                             | 0.127  | Detected Data appear Normal at 5% Significance Level         |                                   |        |   |   |   |   |   |   |  |
| 2395 | <b>Detected Data appear Approximate Normal at 5% Significance Level</b>                                                                  |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2396 |                                                                                                                                          |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2397 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2398 | KM Mean                                                                                                                                  | 9.251  |                                                              | KM Standard Error of Mean         | 0.783  |   |   |   |   |   |   |  |
| 2399 | KM SD                                                                                                                                    | 5.425  |                                                              | 95% KM (BCA) UCL                  | 10.57  |   |   |   |   |   |   |  |
| 2400 | 95% KM (t) UCL                                                                                                                           | 10.56  |                                                              | 95% KM (Percentile Bootstrap) UCL | 10.53  |   |   |   |   |   |   |  |
| 2401 | 95% KM (z) UCL                                                                                                                           | 10.54  |                                                              | 95% KM Bootstrap t UCL            | 10.51  |   |   |   |   |   |   |  |
| 2402 | 90% KM Chebyshev UCL                                                                                                                     | 11.6   |                                                              | 95% KM Chebyshev UCL              | 12.67  |   |   |   |   |   |   |  |
| 2403 | 97.5% KM Chebyshev UCL                                                                                                                   | 14.14  |                                                              | 99% KM Chebyshev UCL              | 17.04  |   |   |   |   |   |   |  |
| 2404 |                                                                                                                                          |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2405 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2406 | A-D Test Statistic                                                                                                                       | 1.816  |                                                              | <b>Anderson-Darling GOF Test</b>  |        |   |   |   |   |   |   |  |
| 2407 | 5% A-D Critical Value                                                                                                                    | 0.762  | Detected Data Not Gamma Distributed at 5% Significance Level |                                   |        |   |   |   |   |   |   |  |
| 2408 | K-S Test Statistic                                                                                                                       | 0.188  |                                                              | <b>Kolmogorov-Smimov GOF</b>      |        |   |   |   |   |   |   |  |
| 2409 | 5% K-S Critical Value                                                                                                                    | 0.13   | Detected Data Not Gamma Distributed at 5% Significance Level |                                   |        |   |   |   |   |   |   |  |
| 2410 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                                      |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2411 |                                                                                                                                          |        |                                                              |                                   |        |   |   |   |   |   |   |  |
| 2412 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |        |                                                              |                                   |        |   |   |   |   |   |   |  |

|      | A                                                                                                                         | B | C | D | E                                                   | F      | G                           | H | I | J                                                    | K | L     |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|---|-----------------------------------------------------|--------|-----------------------------|---|---|------------------------------------------------------|---|-------|
| 2413 |                                                                                                                           |   |   |   | k hat (MLE)                                         | 1.995  |                             |   |   | k star (bias corrected MLE)                          |   | 1.884 |
| 2414 |                                                                                                                           |   |   |   | Theta hat (MLE)                                     | 4.727  |                             |   |   | Theta star (bias corrected MLE)                      |   | 5.005 |
| 2415 |                                                                                                                           |   |   |   | nu hat (MLE)                                        | 191.5  |                             |   |   | nu star (bias corrected)                             |   | 180.9 |
| 2416 |                                                                                                                           |   |   |   | Mean (detects)                                      | 9.431  |                             |   |   |                                                      |   |       |
| 2417 |                                                                                                                           |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2418 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2419 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2420 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2421 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2422 | This is especially true when the sample size is small.                                                                    |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2423 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2424 |                                                                                                                           |   |   |   | Minimum                                             | 0.57   |                             |   |   | Mean                                                 |   | 9.293 |
| 2425 |                                                                                                                           |   |   |   | Maximum                                             | 18.9   |                             |   |   | Median                                               |   | 10.6  |
| 2426 |                                                                                                                           |   |   |   | SD                                                  | 5.422  |                             |   |   | CV                                                   |   | 0.583 |
| 2427 |                                                                                                                           |   |   |   | k hat (MLE)                                         | 1.959  |                             |   |   | k star (bias corrected MLE)                          |   | 1.853 |
| 2428 |                                                                                                                           |   |   |   | Theta hat (MLE)                                     | 4.744  |                             |   |   | Theta star (bias corrected MLE)                      |   | 5.016 |
| 2429 |                                                                                                                           |   |   |   | nu hat (MLE)                                        | 192    |                             |   |   | nu star (bias corrected)                             |   | 181.5 |
| 2430 |                                                                                                                           |   |   |   | Adjusted Level of Significance ( $\beta$ )          | 0.0451 |                             |   |   |                                                      |   |       |
| 2431 |                                                                                                                           |   |   |   | Approximate Chi Square Value (181.55, $\alpha$ )    | 151.4  |                             |   |   | Adjusted Chi Square Value (181.55, $\beta$ )         |   | 150.5 |
| 2432 |                                                                                                                           |   |   |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )   | 11.14  |                             |   |   | 95% Gamma Adjusted UCL (use when $n < 50$ )          |   | 11.21 |
| 2433 |                                                                                                                           |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2434 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2435 |                                                                                                                           |   |   |   | Mean (KM)                                           | 9.251  |                             |   |   | SD (KM)                                              |   | 5.425 |
| 2436 |                                                                                                                           |   |   |   | Variance (KM)                                       | 29.44  |                             |   |   | SE of Mean (KM)                                      |   | 0.783 |
| 2437 |                                                                                                                           |   |   |   | k hat (KM)                                          | 2.907  |                             |   |   | k star (KM)                                          |   | 2.743 |
| 2438 |                                                                                                                           |   |   |   | nu hat (KM)                                         | 284.9  |                             |   |   | nu star (KM)                                         |   | 268.8 |
| 2439 |                                                                                                                           |   |   |   | theta hat (KM)                                      | 3.182  |                             |   |   | theta star (KM)                                      |   | 3.373 |
| 2440 |                                                                                                                           |   |   |   | 80% gamma percentile (KM)                           | 13.34  |                             |   |   | 90% gamma percentile (KM)                            |   | 16.74 |
| 2441 |                                                                                                                           |   |   |   | 95% gamma percentile (KM)                           | 19.93  |                             |   |   | 99% gamma percentile (KM)                            |   | 26.87 |
| 2442 |                                                                                                                           |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2443 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2444 |                                                                                                                           |   |   |   | Approximate Chi Square Value (268.82, $\alpha$ )    | 231.8  |                             |   |   | Adjusted Chi Square Value (268.82, $\beta$ )         |   | 230.8 |
| 2445 |                                                                                                                           |   |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ ) | 10.73  |                             |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )       |   | 10.77 |
| 2446 |                                                                                                                           |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2447 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2448 |                                                                                                                           |   |   |   | Shapiro Wilk Test Statistic                         | 0.851  |                             |   |   | <b>Shapiro Wilk GOF Test</b>                         |   |       |
| 2449 |                                                                                                                           |   |   |   | 5% Shapiro Wilk Critical Value                      | 0.947  |                             |   |   | Detected Data Not Lognormal at 5% Significance Level |   |       |
| 2450 |                                                                                                                           |   |   |   | Lilliefors Test Statistic                           | 0.21   |                             |   |   | <b>Lilliefors GOF Test</b>                           |   |       |
| 2451 |                                                                                                                           |   |   |   | 5% Lilliefors Critical Value                        | 0.127  |                             |   |   | Detected Data Not Lognormal at 5% Significance Level |   |       |
| 2452 | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                               |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2453 |                                                                                                                           |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2454 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2455 |                                                                                                                           |   |   |   | Mean in Original Scale                              | 9.265  |                             |   |   | Mean in Log Scale                                    |   | 1.939 |
| 2456 |                                                                                                                           |   |   |   | SD in Original Scale                                | 5.46   |                             |   |   | SD in Log Scale                                      |   | 0.901 |
| 2457 |                                                                                                                           |   |   |   | 95% t UCL (assumes normality of ROS data)           | 10.57  |                             |   |   | 95% Percentile Bootstrap UCL                         |   | 10.49 |
| 2458 |                                                                                                                           |   |   |   | 95% BCA Bootstrap UCL                               | 10.51  |                             |   |   | 95% Bootstrap t UCL                                  |   | 10.57 |
| 2459 |                                                                                                                           |   |   |   | 95% H-UCL (Log ROS)                                 | 13.94  |                             |   |   |                                                      |   |       |
| 2460 |                                                                                                                           |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2461 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2462 |                                                                                                                           |   |   |   | KM Mean (logged)                                    | 1.923  |                             |   |   | KM Geo Mean                                          |   | 6.843 |
| 2463 |                                                                                                                           |   |   |   | KM SD (logged)                                      | 0.926  |                             |   |   | 95% Critical H Value (KM-Log)                        |   | 2.261 |
| 2464 |                                                                                                                           |   |   |   | KM Standard Error of Mean (logged)                  | 0.134  |                             |   |   | 95% H-UCL (KM -Log)                                  |   | 14.2  |
| 2465 |                                                                                                                           |   |   |   | KM SD (logged)                                      | 0.926  |                             |   |   | 95% Critical H Value (KM-Log)                        |   | 2.261 |
| 2466 |                                                                                                                           |   |   |   | KM Standard Error of Mean (logged)                  | 0.134  |                             |   |   |                                                      |   |       |
| 2467 |                                                                                                                           |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2468 | <b>DL/2 Statistics</b>                                                                                                    |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2469 | <b>DL/2 Normal</b>                                                                                                        |   |   |   |                                                     |        | <b>DL/2 Log-Transformed</b> |   |   |                                                      |   |       |
| 2470 |                                                                                                                           |   |   |   | Mean in Original Scale                              | 9.247  |                             |   |   | Mean in Log Scale                                    |   | 1.916 |
| 2471 |                                                                                                                           |   |   |   | SD in Original Scale                                | 5.488  |                             |   |   | SD in Log Scale                                      |   | 0.954 |
| 2472 |                                                                                                                           |   |   |   | 95% t UCL (Assumes normality)                       | 10.56  |                             |   |   | 95% H-Stat UCL                                       |   | 14.69 |
| 2473 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                  |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2474 |                                                                                                                           |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2475 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                     |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2476 | <b>Detected Data appear Approximate Normal Distributed at 5% Significance Level</b>                                       |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2477 |                                                                                                                           |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2478 | <b>Suggested UCL to Use</b>                                                                                               |   |   |   |                                                     |        |                             |   |   |                                                      |   |       |
| 2479 |                                                                                                                           |   |   |   | 95% KM (t) UCL                                      | 10.56  |                             |   |   |                                                      |   |       |

| A    | B                                                                                                                                        | C      | D | E | F | G | H                                                               | I     | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------|---|---|---|---|-----------------------------------------------------------------|-------|---|---|---|
| 2480 |                                                                                                                                          |        |   |   |   |   |                                                                 |       |   |   |   |
| 2481 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                           |        |   |   |   |   |                                                                 |       |   |   |   |
| 2482 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                   |        |   |   |   |   |                                                                 |       |   |   |   |
| 2483 |                                                                                                                                          |        |   |   |   |   |                                                                 |       |   |   |   |
| 2484 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |   |   |   |   |                                                                 |       |   |   |   |
| 2485 | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |   |   |   |   |                                                                 |       |   |   |   |
| 2486 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |   |   |   |   |                                                                 |       |   |   |   |
| 2487 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |   |   |   |   |                                                                 |       |   |   |   |
| 2488 |                                                                                                                                          |        |   |   |   |   |                                                                 |       |   |   |   |
| 2489 |                                                                                                                                          |        |   |   |   |   |                                                                 |       |   |   |   |
| 2490 | <b>Result (eu2_iron_overbank)</b>                                                                                                        |        |   |   |   |   |                                                                 |       |   |   |   |
| 2491 |                                                                                                                                          |        |   |   |   |   |                                                                 |       |   |   |   |
| 2492 | <b>General Statistics</b>                                                                                                                |        |   |   |   |   |                                                                 |       |   |   |   |
| 2493 | Total Number of Observations                                                                                                             | 34     |   |   |   |   | Number of Distinct Observations                                 | 29    |   |   |   |
| 2494 |                                                                                                                                          |        |   |   |   |   | Number of Missing Observations                                  | 0     |   |   |   |
| 2495 | Minimum                                                                                                                                  | 21800  |   |   |   |   | Mean                                                            | 36959 |   |   |   |
| 2496 | Maximum                                                                                                                                  | 67000  |   |   |   |   | Median                                                          | 33200 |   |   |   |
| 2497 | SD                                                                                                                                       | 12240  |   |   |   |   | Std. Error of Mean                                              | 2099  |   |   |   |
| 2498 | Coefficient of Variation                                                                                                                 | 0.331  |   |   |   |   | Skewness                                                        | 0.922 |   |   |   |
| 2499 |                                                                                                                                          |        |   |   |   |   |                                                                 |       |   |   |   |
| 2500 | <b>Normal GOF Test</b>                                                                                                                   |        |   |   |   |   |                                                                 |       |   |   |   |
| 2501 | Shapiro Wilk Test Statistic                                                                                                              | 0.903  |   |   |   |   | <b>Shapiro Wilk GOF Test</b>                                    |       |   |   |   |
| 2502 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.933  |   |   |   |   | Data Not Normal at 5% Significance Level                        |       |   |   |   |
| 2503 | Lilliefors Test Statistic                                                                                                                | 0.142  |   |   |   |   | <b>Lilliefors GOF Test</b>                                      |       |   |   |   |
| 2504 | 5% Lilliefors Critical Value                                                                                                             | 0.15   |   |   |   |   | Data appear Normal at 5% Significance Level                     |       |   |   |   |
| 2505 | <b>Data appear Approximate Normal at 5% Significance Level</b>                                                                           |        |   |   |   |   |                                                                 |       |   |   |   |
| 2506 |                                                                                                                                          |        |   |   |   |   |                                                                 |       |   |   |   |
| 2507 | <b>Assuming Normal Distribution</b>                                                                                                      |        |   |   |   |   |                                                                 |       |   |   |   |
| 2508 | <b>95% Normal UCL</b>                                                                                                                    |        |   |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b>                         |       |   |   |   |
| 2509 | 95% Student's-t UCL                                                                                                                      | 40511  |   |   |   |   | 95% Adjusted-CLT UCL (Chen-1995)                                | 40766 |   |   |   |
| 2510 |                                                                                                                                          |        |   |   |   |   | 95% Modified-t UCL (Johnson-1978)                               | 40567 |   |   |   |
| 2511 |                                                                                                                                          |        |   |   |   |   |                                                                 |       |   |   |   |
| 2512 | <b>Gamma GOF Test</b>                                                                                                                    |        |   |   |   |   |                                                                 |       |   |   |   |
| 2513 | A-D Test Statistic                                                                                                                       | 0.636  |   |   |   |   | <b>Anderson-Darling Gamma GOF Test</b>                          |       |   |   |   |
| 2514 | 5% A-D Critical Value                                                                                                                    | 0.748  |   |   |   |   | Detected data appear Gamma Distributed at 5% Significance Level |       |   |   |   |
| 2515 | K-S Test Statistic                                                                                                                       | 0.118  |   |   |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |       |   |   |   |
| 2516 | 5% K-S Critical Value                                                                                                                    | 0.151  |   |   |   |   | Detected data appear Gamma Distributed at 5% Significance Level |       |   |   |   |
| 2517 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |        |   |   |   |   |                                                                 |       |   |   |   |
| 2518 |                                                                                                                                          |        |   |   |   |   |                                                                 |       |   |   |   |
| 2519 | <b>Gamma Statistics</b>                                                                                                                  |        |   |   |   |   |                                                                 |       |   |   |   |
| 2520 | k hat (MLE)                                                                                                                              | 10.38  |   |   |   |   | k star (bias corrected MLE)                                     | 9.482 |   |   |   |
| 2521 | Theta hat (MLE)                                                                                                                          | 3561   |   |   |   |   | Theta star (bias corrected MLE)                                 | 3898  |   |   |   |
| 2522 | nu hat (MLE)                                                                                                                             | 705.7  |   |   |   |   | nu star (bias corrected)                                        | 644.7 |   |   |   |
| 2523 | MLE Mean (bias corrected)                                                                                                                | 36959  |   |   |   |   | MLE Sd (bias corrected)                                         | 12003 |   |   |   |
| 2524 |                                                                                                                                          |        |   |   |   |   | Approximate Chi Square Value (0.05)                             | 586.8 |   |   |   |
| 2525 | Adjusted Level of Significance                                                                                                           | 0.0422 |   |   |   |   | Adjusted Chi Square Value                                       | 584.1 |   |   |   |
| 2526 |                                                                                                                                          |        |   |   |   |   |                                                                 |       |   |   |   |
| 2527 | <b>Assuming Gamma Distribution</b>                                                                                                       |        |   |   |   |   |                                                                 |       |   |   |   |
| 2528 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | 40606  |   |   |   |   | 95% Adjusted Gamma UCL (use when n<50)                          | 40795 |   |   |   |
| 2529 |                                                                                                                                          |        |   |   |   |   |                                                                 |       |   |   |   |
| 2530 | <b>Lognormal GOF Test</b>                                                                                                                |        |   |   |   |   |                                                                 |       |   |   |   |
| 2531 | Shapiro Wilk Test Statistic                                                                                                              | 0.951  |   |   |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |       |   |   |   |
| 2532 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.933  |   |   |   |   | Data appear Lognormal at 5% Significance Level                  |       |   |   |   |
| 2533 | Lilliefors Test Statistic                                                                                                                | 0.103  |   |   |   |   | <b>Lilliefors Lognormal GOF Test</b>                            |       |   |   |   |
| 2534 | 5% Lilliefors Critical Value                                                                                                             | 0.15   |   |   |   |   | Data appear Lognormal at 5% Significance Level                  |       |   |   |   |
| 2535 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |        |   |   |   |   |                                                                 |       |   |   |   |
| 2536 |                                                                                                                                          |        |   |   |   |   |                                                                 |       |   |   |   |
| 2537 | <b>Lognormal Statistics</b>                                                                                                              |        |   |   |   |   |                                                                 |       |   |   |   |
| 2538 | Minimum of Logged Data                                                                                                                   | 9.99   |   |   |   |   | Mean of logged Data                                             | 10.47 |   |   |   |
| 2539 | Maximum of Logged Data                                                                                                                   | 11.11  |   |   |   |   | SD of logged Data                                               | 0.312 |   |   |   |
| 2540 |                                                                                                                                          |        |   |   |   |   |                                                                 |       |   |   |   |
| 2541 | <b>Assuming Lognormal Distribution</b>                                                                                                   |        |   |   |   |   |                                                                 |       |   |   |   |
| 2542 | 95% H-UCL                                                                                                                                | 40762  |   |   |   |   | 90% Chebyshev (MVUE) UCL                                        | 42931 |   |   |   |
| 2543 | 95% Chebyshev (MVUE) UCL                                                                                                                 | 45665  |   |   |   |   | 97.5% Chebyshev (MVUE) UCL                                      | 49459 |   |   |   |
| 2544 | 99% Chebyshev (MVUE) UCL                                                                                                                 | 56913  |   |   |   |   |                                                                 |       |   |   |   |
| 2545 |                                                                                                                                          |        |   |   |   |   |                                                                 |       |   |   |   |
| 2546 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |   |   |   |   |                                                                 |       |   |   |   |

| A    | B                                                                                                                                        | C         | D | E | F | G                                       | H | I                                                   | J     | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|-----------|---|---|---|-----------------------------------------|---|-----------------------------------------------------|-------|---|---|
| 2547 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2548 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2549 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2550 | 95% CLT UCL                                                                                                                              | 40412     |   |   |   |                                         |   | 95% Jackknife UCL                                   | 40511 |   |   |
| 2551 | 95% Standard Bootstrap UCL                                                                                                               | 40313     |   |   |   |                                         |   | 95% Bootstrap-t UCL                                 | 40968 |   |   |
| 2552 | 95% Hall's Bootstrap UCL                                                                                                                 | 40689     |   |   |   |                                         |   | 95% Percentile Bootstrap UCL                        | 40409 |   |   |
| 2553 | 95% BCA Bootstrap UCL                                                                                                                    | 40747     |   |   |   |                                         |   |                                                     |       |   |   |
| 2554 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              | 43256     |   |   |   |                                         |   | 95% Chebyshev(Mean, Sd) UCL                         | 46109 |   |   |
| 2555 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            | 50068     |   |   |   |                                         |   | 99% Chebyshev(Mean, Sd) UCL                         | 57845 |   |   |
| 2556 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2557 | <b>Suggested UCL to Use</b>                                                                                                              |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2558 | 95% Student's-t UCL                                                                                                                      | 40511     |   |   |   |                                         |   |                                                     |       |   |   |
| 2559 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2560 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                           |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2561 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                   |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2562 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2563 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2564 | Recommendations are based upon data size, data distribution, and skewness.                                                               |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2565 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2566 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2567 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2568 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2569 | <b>Result (eu2_iron_waste rock)</b>                                                                                                      |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2570 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2571 | <b>General Statistics</b>                                                                                                                |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2572 | Total Number of Observations                                                                                                             | 53        |   |   |   |                                         |   | Number of Distinct Observations                     | 45    |   |   |
| 2573 |                                                                                                                                          |           |   |   |   |                                         |   | Number of Missing Observations                      | 0     |   |   |
| 2574 | Minimum                                                                                                                                  | 5690      |   |   |   |                                         |   | Mean                                                | 28340 |   |   |
| 2575 | Maximum                                                                                                                                  | 55100     |   |   |   |                                         |   | Median                                              | 27900 |   |   |
| 2576 | SD                                                                                                                                       | 9511      |   |   |   |                                         |   | Std. Error of Mean                                  | 1306  |   |   |
| 2577 | Coefficient of Variation                                                                                                                 | 0.336     |   |   |   |                                         |   | Skewness                                            | 0.184 |   |   |
| 2578 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2579 | <b>Normal GOF Test</b>                                                                                                                   |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2580 | Shapiro Wilk Test Statistic                                                                                                              | 0.948     |   |   |   |                                         |   | <b>Shapiro Wilk GOF Test</b>                        |       |   |   |
| 2581 | 5% Shapiro Wilk P Value                                                                                                                  | 0.0372    |   |   |   |                                         |   | Data Not Normal at 5% Significance Level            |       |   |   |
| 2582 | Lilliefors Test Statistic                                                                                                                | 0.164     |   |   |   |                                         |   | <b>Lilliefors GOF Test</b>                          |       |   |   |
| 2583 | 5% Lilliefors Critical Value                                                                                                             | 0.121     |   |   |   |                                         |   | Data Not Normal at 5% Significance Level            |       |   |   |
| 2584 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2585 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2586 | <b>Assuming Normal Distribution</b>                                                                                                      |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2587 | <b>95% Normal UCL</b>                                                                                                                    |           |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |                                                     |       |   |   |
| 2588 | 95% Student's-t UCL                                                                                                                      | 30528     |   |   |   |                                         |   | 95% Adjusted-CLT UCL (Chen-1995)                    | 30524 |   |   |
| 2589 |                                                                                                                                          |           |   |   |   |                                         |   | 95% Modified-t UCL (Johnson-1978)                   | 30533 |   |   |
| 2590 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2591 | <b>Gamma GOF Test</b>                                                                                                                    |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2592 | A-D Test Statistic                                                                                                                       | 2.046     |   |   |   |                                         |   | <b>Anderson-Darling Gamma GOF Test</b>              |       |   |   |
| 2593 | 5% A-D Critical Value                                                                                                                    | 0.752     |   |   |   |                                         |   | Data Not Gamma Distributed at 5% Significance Level |       |   |   |
| 2594 | K-S Test Statistic                                                                                                                       | 0.167     |   |   |   |                                         |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |       |   |   |
| 2595 | 5% K-S Critical Value                                                                                                                    | 0.122     |   |   |   |                                         |   | Data Not Gamma Distributed at 5% Significance Level |       |   |   |
| 2596 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2597 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2598 | <b>Gamma Statistics</b>                                                                                                                  |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2599 | k hat (MLE)                                                                                                                              | 7.088     |   |   |   |                                         |   | k star (bias corrected MLE)                         | 6.699 |   |   |
| 2600 | Theta hat (MLE)                                                                                                                          | 3999      |   |   |   |                                         |   | Theta star (bias corrected MLE)                     | 4230  |   |   |
| 2601 | nu hat (MLE)                                                                                                                             | 751.3     |   |   |   |                                         |   | nu star (bias corrected)                            | 710.1 |   |   |
| 2602 | MLE Mean (bias corrected)                                                                                                                | 28340     |   |   |   |                                         |   | MLE Sd (bias corrected)                             | 10950 |   |   |
| 2603 |                                                                                                                                          |           |   |   |   |                                         |   | Approximate Chi Square Value (0.05)                 | 649.3 |   |   |
| 2604 | Adjusted Level of Significance                                                                                                           | 0.0455    |   |   |   |                                         |   | Adjusted Chi Square Value                           | 647.6 |   |   |
| 2605 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2606 | <b>Assuming Gamma Distribution</b>                                                                                                       |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2607 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | 30995     |   |   |   |                                         |   | 95% Adjusted Gamma UCL (use when n<50)              | 31073 |   |   |
| 2608 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2609 | <b>Lognormal GOF Test</b>                                                                                                                |           |   |   |   |                                         |   |                                                     |       |   |   |
| 2610 | Shapiro Wilk Test Statistic                                                                                                              | 0.823     |   |   |   |                                         |   | <b>Shapiro Wilk Lognormal GOF Test</b>              |       |   |   |
| 2611 | 5% Shapiro Wilk P Value                                                                                                                  | 2.9362E-8 |   |   |   |                                         |   | Data Not Lognormal at 5% Significance Level         |       |   |   |
| 2612 | Lilliefors Test Statistic                                                                                                                | 0.2       |   |   |   |                                         |   | <b>Lilliefors Lognormal GOF Test</b>                |       |   |   |
| 2613 | 5% Lilliefors Critical Value                                                                                                             | 0.121     |   |   |   |                                         |   | Data Not Lognormal at 5% Significance Level         |       |   |   |

| A    | B                                                                                                                                      | C      | D | E                                                   | F     | G | H | I | J | K | L |
|------|----------------------------------------------------------------------------------------------------------------------------------------|--------|---|-----------------------------------------------------|-------|---|---|---|---|---|---|
| 2614 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                     |        |   |                                                     |       |   |   |   |   |   |   |
| 2615 |                                                                                                                                        |        |   |                                                     |       |   |   |   |   |   |   |
| 2616 | <b>Lognormal Statistics</b>                                                                                                            |        |   |                                                     |       |   |   |   |   |   |   |
| 2617 | Minimum of Logged Data                                                                                                                 | 8.646  |   | Mean of logged Data                                 | 10.18 |   |   |   |   |   |   |
| 2618 | Maximum of Logged Data                                                                                                                 | 10.92  |   | SD of logged Data                                   | 0.427 |   |   |   |   |   |   |
| 2619 |                                                                                                                                        |        |   |                                                     |       |   |   |   |   |   |   |
| 2620 | <b>Assuming Lognormal Distribution</b>                                                                                                 |        |   |                                                     |       |   |   |   |   |   |   |
| 2621 | 95% H-UCL                                                                                                                              | 32199  |   | 90% Chebyshev (MVUE) UCL                            | 34090 |   |   |   |   |   |   |
| 2622 | 95% Chebyshev (MVUE) UCL                                                                                                               | 36474  |   | 97.5% Chebyshev (MVUE) UCL                          | 39782 |   |   |   |   |   |   |
| 2623 | 99% Chebyshev (MVUE) UCL                                                                                                               | 46281  |   |                                                     |       |   |   |   |   |   |   |
| 2624 |                                                                                                                                        |        |   |                                                     |       |   |   |   |   |   |   |
| 2625 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                  |        |   |                                                     |       |   |   |   |   |   |   |
| 2626 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                            |        |   |                                                     |       |   |   |   |   |   |   |
| 2627 |                                                                                                                                        |        |   |                                                     |       |   |   |   |   |   |   |
| 2628 | <b>Nonparametric Distribution Free UCLs</b>                                                                                            |        |   |                                                     |       |   |   |   |   |   |   |
| 2629 | 95% CLT UCL                                                                                                                            | 30489  |   | 95% Jackknife UCL                                   | 30528 |   |   |   |   |   |   |
| 2630 | 95% Standard Bootstrap UCL                                                                                                             | 30472  |   | 95% Bootstrap-t UCL                                 | 30545 |   |   |   |   |   |   |
| 2631 | 95% Hall's Bootstrap UCL                                                                                                               | 30673  |   | 95% Percentile Bootstrap UCL                        | 30407 |   |   |   |   |   |   |
| 2632 | 95% BCA Bootstrap UCL                                                                                                                  | 30502  |   |                                                     |       |   |   |   |   |   |   |
| 2633 | 90% Chebyshev(Mean, Sd) UCL                                                                                                            | 32259  |   | 95% Chebyshev(Mean, Sd) UCL                         | 34035 |   |   |   |   |   |   |
| 2634 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                          | 36499  |   | 99% Chebyshev(Mean, Sd) UCL                         | 41339 |   |   |   |   |   |   |
| 2635 |                                                                                                                                        |        |   |                                                     |       |   |   |   |   |   |   |
| 2636 | <b>Suggested UCL to Use</b>                                                                                                            |        |   |                                                     |       |   |   |   |   |   |   |
| 2637 | 95% Student's-t UCL                                                                                                                    | 30528  |   | or 95% Modified-t UCL                               | 30533 |   |   |   |   |   |   |
| 2638 |                                                                                                                                        |        |   |                                                     |       |   |   |   |   |   |   |
| 2639 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.           |        |   |                                                     |       |   |   |   |   |   |   |
| 2640 | Recommendations are based upon data size, data distribution, and skewness.                                                             |        |   |                                                     |       |   |   |   |   |   |   |
| 2641 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).               |        |   |                                                     |       |   |   |   |   |   |   |
| 2642 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistica |        |   |                                                     |       |   |   |   |   |   |   |
| 2643 |                                                                                                                                        |        |   |                                                     |       |   |   |   |   |   |   |
| 2644 |                                                                                                                                        |        |   |                                                     |       |   |   |   |   |   |   |
| 2645 | <b>Result (eu2_manganese_overbank)</b>                                                                                                 |        |   |                                                     |       |   |   |   |   |   |   |
| 2646 |                                                                                                                                        |        |   |                                                     |       |   |   |   |   |   |   |
| 2647 | <b>General Statistics</b>                                                                                                              |        |   |                                                     |       |   |   |   |   |   |   |
| 2648 | Total Number of Observations                                                                                                           | 34     |   | Number of Distinct Observations                     | 34    |   |   |   |   |   |   |
| 2649 |                                                                                                                                        |        |   | Number of Missing Observations                      | 0     |   |   |   |   |   |   |
| 2650 | Minimum                                                                                                                                | 918    |   | Mean                                                | 5927  |   |   |   |   |   |   |
| 2651 | Maximum                                                                                                                                | 43000  |   | Median                                              | 2535  |   |   |   |   |   |   |
| 2652 | SD                                                                                                                                     | 7850   |   | Std. Error of Mean                                  | 1346  |   |   |   |   |   |   |
| 2653 | Coefficient of Variation                                                                                                               | 1.324  |   | Skewness                                            | 3.433 |   |   |   |   |   |   |
| 2654 |                                                                                                                                        |        |   |                                                     |       |   |   |   |   |   |   |
| 2655 | <b>Normal GOF Test</b>                                                                                                                 |        |   |                                                     |       |   |   |   |   |   |   |
| 2656 | Shapiro Wilk Test Statistic                                                                                                            | 0.619  |   | <b>Shapiro Wilk GOF Test</b>                        |       |   |   |   |   |   |   |
| 2657 | 5% Shapiro Wilk Critical Value                                                                                                         | 0.933  |   | Data Not Normal at 5% Significance Level            |       |   |   |   |   |   |   |
| 2658 | Lilliefors Test Statistic                                                                                                              | 0.262  |   | <b>Lilliefors GOF Test</b>                          |       |   |   |   |   |   |   |
| 2659 | 5% Lilliefors Critical Value                                                                                                           | 0.15   |   | Data Not Normal at 5% Significance Level            |       |   |   |   |   |   |   |
| 2660 | <b>Data Not Normal at 5% Significance Level</b>                                                                                        |        |   |                                                     |       |   |   |   |   |   |   |
| 2661 |                                                                                                                                        |        |   |                                                     |       |   |   |   |   |   |   |
| 2662 | <b>Assuming Normal Distribution</b>                                                                                                    |        |   |                                                     |       |   |   |   |   |   |   |
| 2663 | <b>95% Normal UCL</b>                                                                                                                  |        |   | <b>95% UCLs (Adjusted for Skewness)</b>             |       |   |   |   |   |   |   |
| 2664 | 95% Student's-t UCL                                                                                                                    | 8206   |   | 95% Adjusted-CLT UCL (Chen-1995)                    | 8989  |   |   |   |   |   |   |
| 2665 |                                                                                                                                        |        |   | 95% Modified-t UCL (Johnson-1978)                   | 8338  |   |   |   |   |   |   |
| 2666 |                                                                                                                                        |        |   |                                                     |       |   |   |   |   |   |   |
| 2667 | <b>Gamma GOF Test</b>                                                                                                                  |        |   |                                                     |       |   |   |   |   |   |   |
| 2668 | A-D Test Statistic                                                                                                                     | 1.411  |   | <b>Anderson-Darling Gamma GOF Test</b>              |       |   |   |   |   |   |   |
| 2669 | 5% A-D Critical Value                                                                                                                  | 0.774  |   | Data Not Gamma Distributed at 5% Significance Level |       |   |   |   |   |   |   |
| 2670 | K-S Test Statistic                                                                                                                     | 0.186  |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |       |   |   |   |   |   |   |
| 2671 | 5% K-S Critical Value                                                                                                                  | 0.155  |   | Data Not Gamma Distributed at 5% Significance Level |       |   |   |   |   |   |   |
| 2672 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                             |        |   |                                                     |       |   |   |   |   |   |   |
| 2673 |                                                                                                                                        |        |   |                                                     |       |   |   |   |   |   |   |
| 2674 | <b>Gamma Statistics</b>                                                                                                                |        |   |                                                     |       |   |   |   |   |   |   |
| 2675 | k hat (MLE)                                                                                                                            | 1.071  |   | k star (bias corrected MLE)                         | 0.996 |   |   |   |   |   |   |
| 2676 | Theta hat (MLE)                                                                                                                        | 5536   |   | Theta star (bias corrected MLE)                     | 5953  |   |   |   |   |   |   |
| 2677 | nu hat (MLE)                                                                                                                           | 72.8   |   | nu star (bias corrected)                            | 67.71 |   |   |   |   |   |   |
| 2678 | MLE Mean (bias corrected)                                                                                                              | 5927   |   | MLE Sd (bias corrected)                             | 5940  |   |   |   |   |   |   |
| 2679 |                                                                                                                                        |        |   | Approximate Chi Square Value (0.05)                 | 49.77 |   |   |   |   |   |   |
| 2680 | Adjusted Level of Significance                                                                                                         | 0.0422 |   | Adjusted Chi Square Value                           | 49.01 |   |   |   |   |   |   |

| A    | B                                                                                                                                        | C | D     | E                                                   | F                                           | G                                      | H | I     | J     | K    | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|-------|-----------------------------------------------------|---------------------------------------------|----------------------------------------|---|-------|-------|------|---|
| 2681 |                                                                                                                                          |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2682 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2683 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |       |                                                     | 8064                                        | 95% Adjusted Gamma UCL (use when n<50) |   |       |       | 8189 |   |
| 2684 |                                                                                                                                          |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2685 | <b>Lognormal GOF Test</b>                                                                                                                |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2686 | Shapiro Wilk Test Statistic                                                                                                              |   |       | 0.921                                               | <b>Shapiro Wilk Lognormal GOF Test</b>      |                                        |   |       |       |      |   |
| 2687 | 5% Shapiro Wilk Critical Value                                                                                                           |   |       | 0.933                                               | Data Not Lognormal at 5% Significance Level |                                        |   |       |       |      |   |
| 2688 | Lilliefors Test Statistic                                                                                                                |   |       | 0.15                                                | <b>Lilliefors Lognormal GOF Test</b>        |                                        |   |       |       |      |   |
| 2689 | 5% Lilliefors Critical Value                                                                                                             |   |       | 0.15                                                | Data Not Lognormal at 5% Significance Level |                                        |   |       |       |      |   |
| 2690 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2691 |                                                                                                                                          |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2692 | <b>Lognormal Statistics</b>                                                                                                              |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2693 | Minimum of Logged Data                                                                                                                   |   |       | 6.822                                               | Mean of logged Data                         |                                        |   |       | 8.152 |      |   |
| 2694 | Maximum of Logged Data                                                                                                                   |   |       | 10.67                                               | SD of logged Data                           |                                        |   |       | 0.999 |      |   |
| 2695 |                                                                                                                                          |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2696 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2697 | 95% H-UCL                                                                                                                                |   | 8747  | 90% Chebyshev (MVUE) UCL                            |                                             |                                        |   | 8924  |       |      |   |
| 2698 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 10431 | 97.5% Chebyshev (MVUE) UCL                          |                                             |                                        |   | 12522 |       |      |   |
| 2699 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 16630 |                                                     |                                             |                                        |   |       |       |      |   |
| 2700 |                                                                                                                                          |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2701 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2702 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2703 |                                                                                                                                          |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2704 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2705 | 95% CLT UCL                                                                                                                              |   | 8142  | 95% Jackknife UCL                                   |                                             |                                        |   | 8206  |       |      |   |
| 2706 | 95% Standard Bootstrap UCL                                                                                                               |   | 8095  | 95% Bootstrap-t UCL                                 |                                             |                                        |   | 10056 |       |      |   |
| 2707 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 17657 | 95% Percentile Bootstrap UCL                        |                                             |                                        |   | 8261  |       |      |   |
| 2708 | 95% BCA Bootstrap UCL                                                                                                                    |   | 9329  |                                                     |                                             |                                        |   |       |       |      |   |
| 2709 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 9966  | 95% Chebyshev(Mean, Sd) UCL                         |                                             |                                        |   | 11796 |       |      |   |
| 2710 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 14335 | 99% Chebyshev(Mean, Sd) UCL                         |                                             |                                        |   | 19323 |       |      |   |
| 2711 |                                                                                                                                          |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2712 | <b>Suggested UCL to Use</b>                                                                                                              |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2713 | 95% Chebyshev (Mean, Sd) UCL                                                                                                             |   | 11796 |                                                     |                                             |                                        |   |       |       |      |   |
| 2714 |                                                                                                                                          |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2715 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2716 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2717 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2718 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2719 |                                                                                                                                          |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2720 |                                                                                                                                          |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2721 | <b>Result (eu2_manganese_waste rock)</b>                                                                                                 |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2722 |                                                                                                                                          |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2723 | <b>General Statistics</b>                                                                                                                |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2724 | Total Number of Observations                                                                                                             |   |       | 52                                                  | Number of Distinct Observations             |                                        |   |       | 48    |      |   |
| 2725 |                                                                                                                                          |   |       |                                                     | Number of Missing Observations              |                                        |   |       | 0     |      |   |
| 2726 | Minimum                                                                                                                                  |   | 47.6  | Mean                                                |                                             |                                        |   | 15907 |       |      |   |
| 2727 | Maximum                                                                                                                                  |   | 61300 | Median                                              |                                             |                                        |   | 14150 |       |      |   |
| 2728 | SD                                                                                                                                       |   | 15580 | Std. Error of Mean                                  |                                             |                                        |   | 2161  |       |      |   |
| 2729 | Coefficient of Variation                                                                                                                 |   | 0.979 | Skewness                                            |                                             |                                        |   | 1.382 |       |      |   |
| 2730 |                                                                                                                                          |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2731 | <b>Normal GOF Test</b>                                                                                                                   |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2732 | Shapiro Wilk Test Statistic                                                                                                              |   |       | 0.831                                               | <b>Shapiro Wilk GOF Test</b>                |                                        |   |       |       |      |   |
| 2733 | 5% Shapiro Wilk P Value                                                                                                                  |   |       | 9.9488E-8                                           | Data Not Normal at 5% Significance Level    |                                        |   |       |       |      |   |
| 2734 | Lilliefors Test Statistic                                                                                                                |   |       | 0.169                                               | <b>Lilliefors GOF Test</b>                  |                                        |   |       |       |      |   |
| 2735 | 5% Lilliefors Critical Value                                                                                                             |   |       | 0.122                                               | Data Not Normal at 5% Significance Level    |                                        |   |       |       |      |   |
| 2736 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2737 |                                                                                                                                          |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2738 | <b>Assuming Normal Distribution</b>                                                                                                      |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2739 | <b>95% Normal UCL</b>                                                                                                                    |   |       | <b>95% UCLs (Adjusted for Skewness)</b>             |                                             |                                        |   |       |       |      |   |
| 2740 | 95% Student's-t UCL                                                                                                                      |   | 19526 | 95% Adjusted-CLT UCL (Chen-1995)                    |                                             |                                        |   | 19903 |       |      |   |
| 2741 |                                                                                                                                          |   |       | 95% Modified-t UCL (Johnson-1978)                   |                                             |                                        |   | 19595 |       |      |   |
| 2742 |                                                                                                                                          |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2743 | <b>Gamma GOF Test</b>                                                                                                                    |   |       |                                                     |                                             |                                        |   |       |       |      |   |
| 2744 | A-D Test Statistic                                                                                                                       |   | 1.683 | <b>Anderson-Darling Gamma GOF Test</b>              |                                             |                                        |   |       |       |      |   |
| 2745 | 5% A-D Critical Value                                                                                                                    |   | 0.798 | Data Not Gamma Distributed at 5% Significance Level |                                             |                                        |   |       |       |      |   |
| 2746 | K-S Test Statistic                                                                                                                       |   | 0.198 | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |                                             |                                        |   |       |       |      |   |
| 2747 | 5% K-S Critical Value                                                                                                                    |   | 0.129 | Data Not Gamma Distributed at 5% Significance Level |                                             |                                        |   |       |       |      |   |

| A    | B                                                                                                                                        | C         | D | E                                                    | F      | G | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|-----------|---|------------------------------------------------------|--------|---|---|---|---|---|---|
| 2748 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |           |   |                                                      |        |   |   |   |   |   |   |
| 2749 |                                                                                                                                          |           |   |                                                      |        |   |   |   |   |   |   |
| 2750 | <b>Gamma Statistics</b>                                                                                                                  |           |   |                                                      |        |   |   |   |   |   |   |
| 2751 | k hat (MLE)                                                                                                                              | 0.689     |   | k star (bias corrected MLE)                          | 0.662  |   |   |   |   |   |   |
| 2752 | Theta hat (MLE)                                                                                                                          | 23083     |   | Theta star (bias corrected MLE)                      | 24022  |   |   |   |   |   |   |
| 2753 | nu hat (MLE)                                                                                                                             | 71.67     |   | nu star (bias corrected)                             | 68.87  |   |   |   |   |   |   |
| 2754 | MLE Mean (bias corrected)                                                                                                                | 15907     |   | MLE Sd (bias corrected)                              | 19548  |   |   |   |   |   |   |
| 2755 |                                                                                                                                          |           |   | Approximate Chi Square Value (0.05)                  | 50.76  |   |   |   |   |   |   |
| 2756 | Adjusted Level of Significance                                                                                                           | 0.0454    |   | Adjusted Chi Square Value                            | 50.32  |   |   |   |   |   |   |
| 2757 |                                                                                                                                          |           |   |                                                      |        |   |   |   |   |   |   |
| 2758 | <b>Assuming Gamma Distribution</b>                                                                                                       |           |   |                                                      |        |   |   |   |   |   |   |
| 2759 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | 21579     |   | 95% Adjusted Gamma UCL (use when n<50)               | 21769  |   |   |   |   |   |   |
| 2760 |                                                                                                                                          |           |   |                                                      |        |   |   |   |   |   |   |
| 2761 | <b>Lognormal GOF Test</b>                                                                                                                |           |   |                                                      |        |   |   |   |   |   |   |
| 2762 | Shapiro Wilk Test Statistic                                                                                                              | 0.847     |   | <b>Shapiro Wilk Lognormal GOF Test</b>               |        |   |   |   |   |   |   |
| 2763 | 5% Shapiro Wilk P Value                                                                                                                  | 5.5298E-7 |   | Data Not Lognormal at 5% Significance Level          |        |   |   |   |   |   |   |
| 2764 | Lilliefors Test Statistic                                                                                                                | 0.255     |   | <b>Lilliefors Lognormal GOF Test</b>                 |        |   |   |   |   |   |   |
| 2765 | 5% Lilliefors Critical Value                                                                                                             | 0.122     |   | Data Not Lognormal at 5% Significance Level          |        |   |   |   |   |   |   |
| 2766 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |           |   |                                                      |        |   |   |   |   |   |   |
| 2767 |                                                                                                                                          |           |   |                                                      |        |   |   |   |   |   |   |
| 2768 | <b>Lognormal Statistics</b>                                                                                                              |           |   |                                                      |        |   |   |   |   |   |   |
| 2769 | Minimum of Logged Data                                                                                                                   | 3.863     |   | Mean of logged Data                                  | 8.796  |   |   |   |   |   |   |
| 2770 | Maximum of Logged Data                                                                                                                   | 11.02     |   | SD of logged Data                                    | 1.808  |   |   |   |   |   |   |
| 2771 |                                                                                                                                          |           |   |                                                      |        |   |   |   |   |   |   |
| 2772 | <b>Assuming Lognormal Distribution</b>                                                                                                   |           |   |                                                      |        |   |   |   |   |   |   |
| 2773 | 95% H-UCL                                                                                                                                | 78281     |   | 90% Chebyshev (MVUE) UCL                             | 64817  |   |   |   |   |   |   |
| 2774 | 95% Chebyshev (MVUE) UCL                                                                                                                 | 79978     |   | 97.5% Chebyshev (MVUE) UCL                           | 101019 |   |   |   |   |   |   |
| 2775 | 99% Chebyshev (MVUE) UCL                                                                                                                 | 142352    |   |                                                      |        |   |   |   |   |   |   |
| 2776 |                                                                                                                                          |           |   |                                                      |        |   |   |   |   |   |   |
| 2777 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |           |   |                                                      |        |   |   |   |   |   |   |
| 2778 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |           |   |                                                      |        |   |   |   |   |   |   |
| 2779 |                                                                                                                                          |           |   |                                                      |        |   |   |   |   |   |   |
| 2780 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |           |   |                                                      |        |   |   |   |   |   |   |
| 2781 | 95% CLT UCL                                                                                                                              | 19460     |   | 95% Jackknife UCL                                    | 19526  |   |   |   |   |   |   |
| 2782 | 95% Standard Bootstrap UCL                                                                                                               | 19439     |   | 95% Bootstrap-t UCL                                  | 20192  |   |   |   |   |   |   |
| 2783 | 95% Hall's Bootstrap UCL                                                                                                                 | 19961     |   | 95% Percentile Bootstrap UCL                         | 19515  |   |   |   |   |   |   |
| 2784 | 95% BCA Bootstrap UCL                                                                                                                    | 19650     |   |                                                      |        |   |   |   |   |   |   |
| 2785 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              | 22388     |   | 95% Chebyshev(Mean, Sd) UCL                          | 25324  |   |   |   |   |   |   |
| 2786 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            | 29399     |   | 99% Chebyshev(Mean, Sd) UCL                          | 37404  |   |   |   |   |   |   |
| 2787 |                                                                                                                                          |           |   |                                                      |        |   |   |   |   |   |   |
| 2788 | <b>Suggested UCL to Use</b>                                                                                                              |           |   |                                                      |        |   |   |   |   |   |   |
| 2789 | 95% Chebyshev (Mean, Sd) UCL                                                                                                             | 25324     |   |                                                      |        |   |   |   |   |   |   |
| 2790 |                                                                                                                                          |           |   |                                                      |        |   |   |   |   |   |   |
| 2791 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |           |   |                                                      |        |   |   |   |   |   |   |
| 2792 | Recommendations are based upon data size, data distribution, and skewness.                                                               |           |   |                                                      |        |   |   |   |   |   |   |
| 2793 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |           |   |                                                      |        |   |   |   |   |   |   |
| 2794 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |           |   |                                                      |        |   |   |   |   |   |   |
| 2795 |                                                                                                                                          |           |   |                                                      |        |   |   |   |   |   |   |
| 2796 | <b>Result (eu2_thallium_overbank)</b>                                                                                                    |           |   |                                                      |        |   |   |   |   |   |   |
| 2797 |                                                                                                                                          |           |   |                                                      |        |   |   |   |   |   |   |
| 2798 | <b>General Statistics</b>                                                                                                                |           |   |                                                      |        |   |   |   |   |   |   |
| 2799 | Total Number of Observations                                                                                                             | 28        |   | Number of Distinct Observations                      | 19     |   |   |   |   |   |   |
| 2800 | Number of Detects                                                                                                                        | 4         |   | Number of Non-Detects                                | 24     |   |   |   |   |   |   |
| 2801 | Number of Distinct Detects                                                                                                               | 4         |   | Number of Distinct Non-Detects                       | 15     |   |   |   |   |   |   |
| 2802 | Minimum Detect                                                                                                                           | 0.45      |   | Minimum Non-Detect                                   | 0.039  |   |   |   |   |   |   |
| 2803 | Maximum Detect                                                                                                                           | 1.94      |   | Maximum Non-Detect                                   | 1.01   |   |   |   |   |   |   |
| 2804 | Variance Detects                                                                                                                         | 0.421     |   | Percent Non-Detects                                  | 85.71% |   |   |   |   |   |   |
| 2805 | Mean Detects                                                                                                                             | 1.385     |   | SD Detects                                           | 0.649  |   |   |   |   |   |   |
| 2806 | Median Detects                                                                                                                           | 1.575     |   | CV Detects                                           | 0.468  |   |   |   |   |   |   |
| 2807 | Skewness Detects                                                                                                                         | -1.533    |   | Kurtosis Detects                                     | 2.745  |   |   |   |   |   |   |
| 2808 | Mean of Logged Detects                                                                                                                   | 0.193     |   | SD of Logged Detects                                 | 0.669  |   |   |   |   |   |   |
| 2809 |                                                                                                                                          |           |   |                                                      |        |   |   |   |   |   |   |
| 2810 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |           |   |                                                      |        |   |   |   |   |   |   |
| 2811 | Shapiro Wilk Test Statistic                                                                                                              | 0.866     |   | <b>Shapiro Wilk GOF Test</b>                         |        |   |   |   |   |   |   |
| 2812 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.748     |   | Detected Data appear Normal at 5% Significance Level |        |   |   |   |   |   |   |
| 2813 | Lilliefors Test Statistic                                                                                                                | 0.326     |   | <b>Lilliefors GOF Test</b>                           |        |   |   |   |   |   |   |
| 2814 | 5% Lilliefors Critical Value                                                                                                             | 0.375     |   | Detected Data appear Normal at 5% Significance Level |        |   |   |   |   |   |   |

|      | A                                                                                                                         | B                                                   | C      | D | E | F                                                               | G | H | I | J | K      | L |
|------|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|--------|---|---|-----------------------------------------------------------------|---|---|---|---|--------|---|
| 2815 | <b>Detected Data appear Normal at 5% Significance Level</b>                                                               |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2816 |                                                                                                                           |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2817 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2818 |                                                                                                                           | KM Mean                                             | 0.235  |   |   | KM Standard Error of Mean                                       |   |   |   |   | 0.113  |   |
| 2819 |                                                                                                                           | KM SD                                               | 0.517  |   |   | 95% KM (BCA) UCL                                                |   |   |   |   | N/A    |   |
| 2820 |                                                                                                                           | 95% KM (t) UCL                                      | 0.428  |   |   | 95% KM (Percentile Bootstrap) UCL                               |   |   |   |   | N/A    |   |
| 2821 |                                                                                                                           | 95% KM (z) UCL                                      | 0.421  |   |   | 95% KM Bootstrap t UCL                                          |   |   |   |   | N/A    |   |
| 2822 |                                                                                                                           | 90% KM Chebyshev UCL                                | 0.574  |   |   | 95% KM Chebyshev UCL                                            |   |   |   |   | 0.728  |   |
| 2823 |                                                                                                                           | 97.5% KM Chebyshev UCL                              | 0.942  |   |   | 99% KM Chebyshev UCL                                            |   |   |   |   | 1.361  |   |
| 2824 |                                                                                                                           |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2825 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2826 |                                                                                                                           | A-D Test Statistic                                  | 0.584  |   |   | <b>Anderson-Darling GOF Test</b>                                |   |   |   |   |        |   |
| 2827 |                                                                                                                           | 5% A-D Critical Value                               | 0.659  |   |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |   |        |   |
| 2828 |                                                                                                                           | K-S Test Statistic                                  | 0.384  |   |   | <b>Kolmogorov-Smirnov GOF</b>                                   |   |   |   |   |        |   |
| 2829 |                                                                                                                           | 5% K-S Critical Value                               | 0.396  |   |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |   |        |   |
| 2830 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                    |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2831 |                                                                                                                           |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2832 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2833 |                                                                                                                           | k hat (MLE)                                         | 3.92   |   |   | k star (bias corrected MLE)                                     |   |   |   |   | 1.147  |   |
| 2834 |                                                                                                                           | Theta hat (MLE)                                     | 0.353  |   |   | Theta star (bias corrected MLE)                                 |   |   |   |   | 1.208  |   |
| 2835 |                                                                                                                           | nu hat (MLE)                                        | 31.36  |   |   | nu star (bias corrected)                                        |   |   |   |   | 9.173  |   |
| 2836 |                                                                                                                           | Mean (detects)                                      | 1.385  |   |   |                                                                 |   |   |   |   |        |   |
| 2837 |                                                                                                                           |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2838 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2839 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2840 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2841 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2842 | This is especially true when the sample size is small.                                                                    |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2843 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2844 |                                                                                                                           | Minimum                                             | 0.01   |   |   | Mean                                                            |   |   |   |   | 0.206  |   |
| 2845 |                                                                                                                           | Maximum                                             | 1.94   |   |   | Median                                                          |   |   |   |   | 0.01   |   |
| 2846 |                                                                                                                           | SD                                                  | 0.536  |   |   | CV                                                              |   |   |   |   | 2.595  |   |
| 2847 |                                                                                                                           | k hat (MLE)                                         | 0.295  |   |   | k star (bias corrected MLE)                                     |   |   |   |   | 0.287  |   |
| 2848 |                                                                                                                           | Theta hat (MLE)                                     | 0.699  |   |   | Theta star (bias corrected MLE)                                 |   |   |   |   | 0.718  |   |
| 2849 |                                                                                                                           | nu hat (MLE)                                        | 16.53  |   |   | nu star (bias corrected)                                        |   |   |   |   | 16.09  |   |
| 2850 |                                                                                                                           | Adjusted Level of Significance ( $\beta$ )          | 0.0404 |   |   |                                                                 |   |   |   |   |        |   |
| 2851 |                                                                                                                           | Approximate Chi Square Value (16.09, $\alpha$ )     | 8.029  |   |   | Adjusted Chi Square Value (16.09, $\beta$ )                     |   |   |   |   | 7.677  |   |
| 2852 |                                                                                                                           | 95% Gamma Approximate UCL (use when $n \geq 50$ )   | 0.414  |   |   | 95% Gamma Adjusted UCL (use when $n < 50$ )                     |   |   |   |   | N/A    |   |
| 2853 |                                                                                                                           |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2854 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2855 |                                                                                                                           | Mean (KM)                                           | 0.235  |   |   | SD (KM)                                                         |   |   |   |   | 0.517  |   |
| 2856 |                                                                                                                           | Variance (KM)                                       | 0.267  |   |   | SE of Mean (KM)                                                 |   |   |   |   | 0.113  |   |
| 2857 |                                                                                                                           | k hat (KM)                                          | 0.207  |   |   | k star (KM)                                                     |   |   |   |   | 0.208  |   |
| 2858 |                                                                                                                           | nu hat (KM)                                         | 11.58  |   |   | nu star (KM)                                                    |   |   |   |   | 11.67  |   |
| 2859 |                                                                                                                           | theta hat (KM)                                      | 1.137  |   |   | theta star (KM)                                                 |   |   |   |   | 1.127  |   |
| 2860 |                                                                                                                           | 80% gamma percentile (KM)                           | 0.316  |   |   | 90% gamma percentile (KM)                                       |   |   |   |   | 0.711  |   |
| 2861 |                                                                                                                           | 95% gamma percentile (KM)                           | 1.198  |   |   | 99% gamma percentile (KM)                                       |   |   |   |   | 2.529  |   |
| 2862 |                                                                                                                           |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2863 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2864 |                                                                                                                           | Approximate Chi Square Value (11.67, $\alpha$ )     | 5.01   |   |   | Adjusted Chi Square Value (11.67, $\beta$ )                     |   |   |   |   | 4.742  |   |
| 2865 |                                                                                                                           | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ ) | 0.547  |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )                  |   |   |   |   | 0.578  |   |
| 2866 |                                                                                                                           |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2867 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2868 |                                                                                                                           | Shapiro Wilk Test Statistic                         | 0.772  |   |   | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |   |        |   |
| 2869 |                                                                                                                           | 5% Shapiro Wilk Critical Value                      | 0.748  |   |   | Detected Data appear Lognormal at 5% Significance Level         |   |   |   |   |        |   |
| 2870 |                                                                                                                           | Lilliefors Test Statistic                           | 0.379  |   |   | <b>Lilliefors GOF Test</b>                                      |   |   |   |   |        |   |
| 2871 |                                                                                                                           | 5% Lilliefors Critical Value                        | 0.375  |   |   | Detected Data Not Lognormal at 5% Significance Level            |   |   |   |   |        |   |
| 2872 | <b>Detected Data appear Approximate Lognormal at 5% Significance Level</b>                                                |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2873 |                                                                                                                           |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2874 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2875 |                                                                                                                           | Mean in Original Scale                              | 0.265  |   |   | Mean in Log Scale                                               |   |   |   |   | -2.294 |   |
| 2876 |                                                                                                                           | SD in Original Scale                                | 0.515  |   |   | SD in Log Scale                                                 |   |   |   |   | 1.199  |   |
| 2877 |                                                                                                                           | 95% t UCL (assumes normality of ROS data)           | 0.431  |   |   | 95% Percentile Bootstrap UCL                                    |   |   |   |   | 0.435  |   |
| 2878 |                                                                                                                           | 95% BCA Bootstrap UCL                               | 0.5    |   |   | 95% Bootstrap t UCL                                             |   |   |   |   | 0.521  |   |
| 2879 |                                                                                                                           | 95% H-UCL (Log ROS)                                 | 0.387  |   |   |                                                                 |   |   |   |   |        |   |
| 2880 |                                                                                                                           |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |
| 2881 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |                                                     |        |   |   |                                                                 |   |   |   |   |        |   |

| A    | B | C | D                                                                                                                                        | E | F      | G | H                           | I | J                                                               | K | L      |
|------|---|---|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|---|-----------------------------|---|-----------------------------------------------------------------|---|--------|
| 2882 |   |   | KM Mean (logged)                                                                                                                         |   | -2.731 |   |                             |   | KM Geo Mean                                                     |   | 0.0651 |
| 2883 |   |   | KM SD (logged)                                                                                                                           |   | 1.235  |   |                             |   | 95% Critical H Value (KM-Log)                                   |   | 2.759  |
| 2884 |   |   | KM Standard Error of Mean (logged)                                                                                                       |   | 0.275  |   |                             |   | 95% H-UCL (KM -Log)                                             |   | 0.269  |
| 2885 |   |   | KM SD (logged)                                                                                                                           |   | 1.235  |   |                             |   | 95% Critical H Value (KM-Log)                                   |   | 2.759  |
| 2886 |   |   | KM Standard Error of Mean (logged)                                                                                                       |   | 0.275  |   |                             |   |                                                                 |   |        |
| 2887 |   |   |                                                                                                                                          |   |        |   |                             |   |                                                                 |   |        |
| 2888 |   |   | <b>DL/2 Statistics</b>                                                                                                                   |   |        |   |                             |   |                                                                 |   |        |
| 2889 |   |   | <b>DL/2 Normal</b>                                                                                                                       |   |        |   | <b>DL/2 Log-Transformed</b> |   |                                                                 |   |        |
| 2890 |   |   | Mean in Original Scale                                                                                                                   |   | 0.302  |   |                             |   | Mean in Log Scale                                               |   | -2.695 |
| 2891 |   |   | SD in Original Scale                                                                                                                     |   | 0.532  |   |                             |   | SD in Log Scale                                                 |   | 1.713  |
| 2892 |   |   | 95% t UCL (Assumes normality)                                                                                                            |   | 0.473  |   |                             |   | 95% H-Stat UCL                                                  |   | 0.912  |
| 2893 |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |        |   |                             |   |                                                                 |   |        |
| 2894 |   |   |                                                                                                                                          |   |        |   |                             |   |                                                                 |   |        |
| 2895 |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |        |   |                             |   |                                                                 |   |        |
| 2896 |   |   | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                  |   |        |   |                             |   |                                                                 |   |        |
| 2897 |   |   |                                                                                                                                          |   |        |   |                             |   |                                                                 |   |        |
| 2898 |   |   | <b>Suggested UCL to Use</b>                                                                                                              |   |        |   |                             |   |                                                                 |   |        |
| 2899 |   |   | 95% KM (t) UCL                                                                                                                           |   | 0.428  |   |                             |   |                                                                 |   |        |
| 2900 |   |   |                                                                                                                                          |   |        |   |                             |   |                                                                 |   |        |
| 2901 |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |   |                             |   |                                                                 |   |        |
| 2902 |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |   |                             |   |                                                                 |   |        |
| 2903 |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |   |                             |   |                                                                 |   |        |
| 2904 |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |   |                             |   |                                                                 |   |        |
| 2905 |   |   |                                                                                                                                          |   |        |   |                             |   |                                                                 |   |        |
| 2906 |   |   | <b>Result (eu2_thallium_waste rock)</b>                                                                                                  |   |        |   |                             |   |                                                                 |   |        |
| 2907 |   |   |                                                                                                                                          |   |        |   |                             |   |                                                                 |   |        |
| 2908 |   |   | <b>General Statistics</b>                                                                                                                |   |        |   |                             |   |                                                                 |   |        |
| 2909 |   |   | Total Number of Observations                                                                                                             |   | 53     |   |                             |   | Number of Distinct Observations                                 |   | 34     |
| 2910 |   |   | Number of Detects                                                                                                                        |   | 43     |   |                             |   | Number of Non-Detects                                           |   | 10     |
| 2911 |   |   | Number of Distinct Detects                                                                                                               |   | 25     |   |                             |   | Number of Distinct Non-Detects                                  |   | 9      |
| 2912 |   |   | Minimum Detect                                                                                                                           |   | 0.075  |   |                             |   | Minimum Non-Detect                                              |   | 0.003  |
| 2913 |   |   | Maximum Detect                                                                                                                           |   | 1.04   |   |                             |   | Maximum Non-Detect                                              |   | 1      |
| 2914 |   |   | Variance Detects                                                                                                                         |   | 0.0237 |   |                             |   | Percent Non-Detects                                             |   | 18.87% |
| 2915 |   |   | Mean Detects                                                                                                                             |   | 0.297  |   |                             |   | SD Detects                                                      |   | 0.154  |
| 2916 |   |   | Median Detects                                                                                                                           |   | 0.29   |   |                             |   | CV Detects                                                      |   | 0.519  |
| 2917 |   |   | Skewness Detects                                                                                                                         |   | 2.694  |   |                             |   | Kurtosis Detects                                                |   | 12.42  |
| 2918 |   |   | Mean of Logged Detects                                                                                                                   |   | -1.326 |   |                             |   | SD of Logged Detects                                            |   | 0.486  |
| 2919 |   |   |                                                                                                                                          |   |        |   |                             |   |                                                                 |   |        |
| 2920 |   |   | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |        |   |                             |   |                                                                 |   |        |
| 2921 |   |   | Shapiro Wilk Test Statistic                                                                                                              |   | 0.791  |   |                             |   | <b>Shapiro Wilk GOF Test</b>                                    |   |        |
| 2922 |   |   | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.943  |   |                             |   | Detected Data Not Normal at 5% Significance Level               |   |        |
| 2923 |   |   | Lilliefors Test Statistic                                                                                                                |   | 0.184  |   |                             |   | <b>Lilliefors GOF Test</b>                                      |   |        |
| 2924 |   |   | 5% Lilliefors Critical Value                                                                                                             |   | 0.134  |   |                             |   | Detected Data Not Normal at 5% Significance Level               |   |        |
| 2925 |   |   | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |   |        |   |                             |   |                                                                 |   |        |
| 2926 |   |   |                                                                                                                                          |   |        |   |                             |   |                                                                 |   |        |
| 2927 |   |   | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |        |   |                             |   |                                                                 |   |        |
| 2928 |   |   | KM Mean                                                                                                                                  |   | 0.264  |   |                             |   | KM Standard Error of Mean                                       |   | 0.0238 |
| 2929 |   |   | KM SD                                                                                                                                    |   | 0.166  |   |                             |   | 95% KM (BCA) UCL                                                |   | 0.302  |
| 2930 |   |   | 95% KM (t) UCL                                                                                                                           |   | 0.304  |   |                             |   | 95% KM (Percentile Bootstrap) UCL                               |   | 0.306  |
| 2931 |   |   | 95% KM (z) UCL                                                                                                                           |   | 0.303  |   |                             |   | 95% KM Bootstrap t UCL                                          |   | 0.31   |
| 2932 |   |   | 90% KM Chebyshev UCL                                                                                                                     |   | 0.335  |   |                             |   | 95% KM Chebyshev UCL                                            |   | 0.368  |
| 2933 |   |   | 97.5% KM Chebyshev UCL                                                                                                                   |   | 0.412  |   |                             |   | 99% KM Chebyshev UCL                                            |   | 0.5    |
| 2934 |   |   |                                                                                                                                          |   |        |   |                             |   |                                                                 |   |        |
| 2935 |   |   | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |   |        |   |                             |   |                                                                 |   |        |
| 2936 |   |   | A-D Test Statistic                                                                                                                       |   | 0.906  |   |                             |   | <b>Anderson-Darling GOF Test</b>                                |   |        |
| 2937 |   |   | 5% A-D Critical Value                                                                                                                    |   | 0.753  |   |                             |   | Detected Data Not Gamma Distributed at 5% Significance Level    |   |        |
| 2938 |   |   | K-S Test Statistic                                                                                                                       |   | 0.122  |   |                             |   | <b>Kolmogorov-Smirnov GOF</b>                                   |   |        |
| 2939 |   |   | 5% K-S Critical Value                                                                                                                    |   | 0.135  |   |                             |   | Detected data appear Gamma Distributed at 5% Significance Level |   |        |
| 2940 |   |   | <b>Detected data follow Appr. Gamma Distribution at 5% Significance Level</b>                                                            |   |        |   |                             |   |                                                                 |   |        |
| 2941 |   |   |                                                                                                                                          |   |        |   |                             |   |                                                                 |   |        |
| 2942 |   |   | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |   |        |   |                             |   |                                                                 |   |        |
| 2943 |   |   | k hat (MLE)                                                                                                                              |   | 4.679  |   |                             |   | k star (bias corrected MLE)                                     |   | 4.368  |
| 2944 |   |   | Theta hat (MLE)                                                                                                                          |   | 0.0634 |   |                             |   | Theta star (bias corrected MLE)                                 |   | 0.0679 |
| 2945 |   |   | nu hat (MLE)                                                                                                                             |   | 402.4  |   |                             |   | nu star (bias corrected)                                        |   | 375.7  |
| 2946 |   |   | Mean (detects)                                                                                                                           |   | 0.297  |   |                             |   |                                                                 |   |        |
| 2947 |   |   |                                                                                                                                          |   |        |   |                             |   |                                                                 |   |        |
| 2948 |   |   | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |   |        |   |                             |   |                                                                 |   |        |

| A    | B                                                                                                                            | C      | D                                                    | E      | F | G                           | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------|--------|------------------------------------------------------|--------|---|-----------------------------|---|---|---|---|---|
| 2949 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                 |        |                                                      |        |   |                             |   |   |   |   |   |
| 2950 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)    |        |                                                      |        |   |                             |   |   |   |   |   |
| 2951 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                 |        |                                                      |        |   |                             |   |   |   |   |   |
| 2952 | This is especially true when the sample size is small.                                                                       |        |                                                      |        |   |                             |   |   |   |   |   |
| 2953 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                  |        |                                                      |        |   |                             |   |   |   |   |   |
| 2954 | Minimum                                                                                                                      | 0.0493 | Mean                                                 | 0.27   |   |                             |   |   |   |   |   |
| 2955 | Maximum                                                                                                                      | 1.04   | Median                                               | 0.26   |   |                             |   |   |   |   |   |
| 2956 | SD                                                                                                                           | 0.155  | CV                                                   | 0.574  |   |                             |   |   |   |   |   |
| 2957 | k hat (MLE)                                                                                                                  | 3.297  | k star (bias corrected MLE)                          | 3.123  |   |                             |   |   |   |   |   |
| 2958 | Theta hat (MLE)                                                                                                              | 0.0818 | Theta star (bias corrected MLE)                      | 0.0863 |   |                             |   |   |   |   |   |
| 2959 | nu hat (MLE)                                                                                                                 | 349.5  | nu star (bias corrected)                             | 331.1  |   |                             |   |   |   |   |   |
| 2960 | Adjusted Level of Significance ( $\beta$ )                                                                                   | 0.0455 |                                                      |        |   |                             |   |   |   |   |   |
| 2961 | Approximate Chi Square Value (331.07, $\alpha$ )                                                                             | 289.9  | Adjusted Chi Square Value (331.07, $\beta$ )         | 288.8  |   |                             |   |   |   |   |   |
| 2962 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                            | 0.308  | 95% Gamma Adjusted UCL (use when $n < 50$ )          | 0.309  |   |                             |   |   |   |   |   |
| 2963 |                                                                                                                              |        |                                                      |        |   |                             |   |   |   |   |   |
| 2964 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                      |        |                                                      |        |   |                             |   |   |   |   |   |
| 2965 | Mean (KM)                                                                                                                    | 0.264  | SD (KM)                                              | 0.166  |   |                             |   |   |   |   |   |
| 2966 | Variance (KM)                                                                                                                | 0.0276 | SE of Mean (KM)                                      | 0.0238 |   |                             |   |   |   |   |   |
| 2967 | k hat (KM)                                                                                                                   | 2.53   | k star (KM)                                          | 2.399  |   |                             |   |   |   |   |   |
| 2968 | nu hat (KM)                                                                                                                  | 268.2  | nu star (KM)                                         | 254.3  |   |                             |   |   |   |   |   |
| 2969 | theta hat (KM)                                                                                                               | 0.104  | theta star (KM)                                      | 0.11   |   |                             |   |   |   |   |   |
| 2970 | 80% gamma percentile (KM)                                                                                                    | 0.387  | 90% gamma percentile (KM)                            | 0.493  |   |                             |   |   |   |   |   |
| 2971 | 95% gamma percentile (KM)                                                                                                    | 0.592  | 99% gamma percentile (KM)                            | 0.811  |   |                             |   |   |   |   |   |
| 2972 |                                                                                                                              |        |                                                      |        |   |                             |   |   |   |   |   |
| 2973 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                    |        |                                                      |        |   |                             |   |   |   |   |   |
| 2974 | Approximate Chi Square Value (254.34, $\alpha$ )                                                                             | 218.4  | Adjusted Chi Square Value (254.34, $\beta$ )         | 217.5  |   |                             |   |   |   |   |   |
| 2975 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                          | 0.308  | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )       | 0.309  |   |                             |   |   |   |   |   |
| 2976 |                                                                                                                              |        |                                                      |        |   |                             |   |   |   |   |   |
| 2977 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                      |        |                                                      |        |   |                             |   |   |   |   |   |
| 2978 | Shapiro Wilk Test Statistic                                                                                                  | 0.937  | <b>Shapiro Wilk GOF Test</b>                         |        |   |                             |   |   |   |   |   |
| 2979 | 5% Shapiro Wilk Critical Value                                                                                               | 0.943  | Detected Data Not Lognormal at 5% Significance Level |        |   |                             |   |   |   |   |   |
| 2980 | Lilliefors Test Statistic                                                                                                    | 0.139  | <b>Lilliefors GOF Test</b>                           |        |   |                             |   |   |   |   |   |
| 2981 | 5% Lilliefors Critical Value                                                                                                 | 0.134  | Detected Data Not Lognormal at 5% Significance Level |        |   |                             |   |   |   |   |   |
| 2982 | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                                  |        |                                                      |        |   |                             |   |   |   |   |   |
| 2983 |                                                                                                                              |        |                                                      |        |   |                             |   |   |   |   |   |
| 2984 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                    |        |                                                      |        |   |                             |   |   |   |   |   |
| 2985 | Mean in Original Scale                                                                                                       | 0.272  | Mean in Log Scale                                    | -1.433 |   |                             |   |   |   |   |   |
| 2986 | SD in Original Scale                                                                                                         | 0.151  | SD in Log Scale                                      | 0.528  |   |                             |   |   |   |   |   |
| 2987 | 95% t UCL (assumes normality of ROS data)                                                                                    | 0.306  | 95% Percentile Bootstrap UCL                         | 0.307  |   |                             |   |   |   |   |   |
| 2988 | 95% BCA Bootstrap UCL                                                                                                        | 0.313  | 95% Bootstrap t UCL                                  | 0.317  |   |                             |   |   |   |   |   |
| 2989 | 95% H-UCL (Log ROS)                                                                                                          | 0.315  |                                                      |        |   |                             |   |   |   |   |   |
| 2990 |                                                                                                                              |        |                                                      |        |   |                             |   |   |   |   |   |
| 2991 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                      |        |                                                      |        |   |                             |   |   |   |   |   |
| 2992 | KM Mean (logged)                                                                                                             | -1.798 | KM Geo Mean                                          | 0.166  |   |                             |   |   |   |   |   |
| 2993 | KM SD (logged)                                                                                                               | 1.442  | 95% Critical H Value (KM-Log)                        | 2.88   |   |                             |   |   |   |   |   |
| 2994 | KM Standard Error of Mean (logged)                                                                                           | 0.211  | 95% H-UCL (KM -Log)                                  | 0.833  |   |                             |   |   |   |   |   |
| 2995 | KM SD (logged)                                                                                                               | 1.442  | 95% Critical H Value (KM-Log)                        | 2.88   |   |                             |   |   |   |   |   |
| 2996 | KM Standard Error of Mean (logged)                                                                                           | 0.211  |                                                      |        |   |                             |   |   |   |   |   |
| 2997 |                                                                                                                              |        |                                                      |        |   |                             |   |   |   |   |   |
| 2998 | <b>DL/2 Statistics</b>                                                                                                       |        |                                                      |        |   |                             |   |   |   |   |   |
| 2999 | <b>DL/2 Normal</b>                                                                                                           |        |                                                      |        |   | <b>DL/2 Log-Transformed</b> |   |   |   |   |   |
| 3000 | Mean in Original Scale                                                                                                       | 0.279  | Mean in Log Scale                                    | -1.745 |   |                             |   |   |   |   |   |
| 3001 | SD in Original Scale                                                                                                         | 0.172  | SD in Log Scale                                      | 1.507  |   |                             |   |   |   |   |   |
| 3002 | 95% t UCL (Assumes normality)                                                                                                | 0.318  | 95% H-Stat UCL                                       | 1.009  |   |                             |   |   |   |   |   |
| 3003 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                     |        |                                                      |        |   |                             |   |   |   |   |   |
| 3004 |                                                                                                                              |        |                                                      |        |   |                             |   |   |   |   |   |
| 3005 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                        |        |                                                      |        |   |                             |   |   |   |   |   |
| 3006 | <b>Detected Data appear Approximate Gamma Distributed at 5% Significance Level</b>                                           |        |                                                      |        |   |                             |   |   |   |   |   |
| 3007 |                                                                                                                              |        |                                                      |        |   |                             |   |   |   |   |   |
| 3008 | <b>Suggested UCL to Use</b>                                                                                                  |        |                                                      |        |   |                             |   |   |   |   |   |
| 3009 | 95% KM Approximate Gamma UCL                                                                                                 | 0.308  | 95% GROS Approximate Gamma UCL                       | 0.308  |   |                             |   |   |   |   |   |
| 3010 |                                                                                                                              |        |                                                      |        |   |                             |   |   |   |   |   |
| 3011 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                               |        |                                                      |        |   |                             |   |   |   |   |   |
| 3012 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL       |        |                                                      |        |   |                             |   |   |   |   |   |
| 3013 |                                                                                                                              |        |                                                      |        |   |                             |   |   |   |   |   |
| 3014 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. |        |                                                      |        |   |                             |   |   |   |   |   |
| 3015 | Recommendations are based upon data size, data distribution, and skewness.                                                   |        |                                                      |        |   |                             |   |   |   |   |   |

| A    | B                                                                                                                                        | C      | D                                                   | E | F     | G | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------|---|-------|---|---|---|---|---|---|
| 3016 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |                                                     |   |       |   |   |   |   |   |   |
| 3017 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |                                                     |   |       |   |   |   |   |   |   |
| 3018 |                                                                                                                                          |        |                                                     |   |       |   |   |   |   |   |   |
| 3019 |                                                                                                                                          |        |                                                     |   |       |   |   |   |   |   |   |
| 3020 | <b>Result (eu2_zinc_overbank)</b>                                                                                                        |        |                                                     |   |       |   |   |   |   |   |   |
| 3021 |                                                                                                                                          |        |                                                     |   |       |   |   |   |   |   |   |
| 3022 | <b>General Statistics</b>                                                                                                                |        |                                                     |   |       |   |   |   |   |   |   |
| 3023 | Total Number of Observations                                                                                                             | 34     | Number of Distinct Observations                     |   | 34    |   |   |   |   |   |   |
| 3024 |                                                                                                                                          |        | Number of Missing Observations                      |   | 0     |   |   |   |   |   |   |
| 3025 | Minimum                                                                                                                                  | 121    | Mean                                                |   | 1409  |   |   |   |   |   |   |
| 3026 | Maximum                                                                                                                                  | 5370   | Median                                              |   | 676.5 |   |   |   |   |   |   |
| 3027 | SD                                                                                                                                       | 1406   | Std. Error of Mean                                  |   | 241.1 |   |   |   |   |   |   |
| 3028 | Coefficient of Variation                                                                                                                 | 0.998  | Skewness                                            |   | 1.221 |   |   |   |   |   |   |
| 3029 |                                                                                                                                          |        |                                                     |   |       |   |   |   |   |   |   |
| 3030 | <b>Normal GOF Test</b>                                                                                                                   |        |                                                     |   |       |   |   |   |   |   |   |
| 3031 | Shapiro Wilk Test Statistic                                                                                                              | 0.825  | <b>Shapiro Wilk GOF Test</b>                        |   |       |   |   |   |   |   |   |
| 3032 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.933  | Data Not Normal at 5% Significance Level            |   |       |   |   |   |   |   |   |
| 3033 | Lilliefors Test Statistic                                                                                                                | 0.225  | <b>Lilliefors GOF Test</b>                          |   |       |   |   |   |   |   |   |
| 3034 | 5% Lilliefors Critical Value                                                                                                             | 0.15   | Data Not Normal at 5% Significance Level            |   |       |   |   |   |   |   |   |
| 3035 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |        |                                                     |   |       |   |   |   |   |   |   |
| 3036 |                                                                                                                                          |        |                                                     |   |       |   |   |   |   |   |   |
| 3037 | <b>Assuming Normal Distribution</b>                                                                                                      |        |                                                     |   |       |   |   |   |   |   |   |
| 3038 | <b>95% Normal UCL</b>                                                                                                                    |        | <b>95% UCLs (Adjusted for Skewness)</b>             |   |       |   |   |   |   |   |   |
| 3039 | 95% Student's-t UCL                                                                                                                      | 1817   | 95% Adjusted-CLT UCL (Chen-1995)                    |   | 1859  |   |   |   |   |   |   |
| 3040 |                                                                                                                                          |        | 95% Modified-t UCL (Johnson-1978)                   |   | 1825  |   |   |   |   |   |   |
| 3041 |                                                                                                                                          |        |                                                     |   |       |   |   |   |   |   |   |
| 3042 | <b>Gamma GOF Test</b>                                                                                                                    |        |                                                     |   |       |   |   |   |   |   |   |
| 3043 | A-D Test Statistic                                                                                                                       | 0.885  | <b>Anderson-Darling Gamma GOF Test</b>              |   |       |   |   |   |   |   |   |
| 3044 | 5% A-D Critical Value                                                                                                                    | 0.774  | Data Not Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |   |   |
| 3045 | K-S Test Statistic                                                                                                                       | 0.159  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |       |   |   |   |   |   |   |
| 3046 | 5% K-S Critical Value                                                                                                                    | 0.155  | Data Not Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |   |   |
| 3047 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |        |                                                     |   |       |   |   |   |   |   |   |
| 3048 |                                                                                                                                          |        |                                                     |   |       |   |   |   |   |   |   |
| 3049 | <b>Gamma Statistics</b>                                                                                                                  |        |                                                     |   |       |   |   |   |   |   |   |
| 3050 | k hat (MLE)                                                                                                                              | 1.078  | k star (bias corrected MLE)                         |   | 1.002 |   |   |   |   |   |   |
| 3051 | Theta hat (MLE)                                                                                                                          | 1307   | Theta star (bias corrected MLE)                     |   | 1405  |   |   |   |   |   |   |
| 3052 | nu hat (MLE)                                                                                                                             | 73.3   | nu star (bias corrected)                            |   | 68.17 |   |   |   |   |   |   |
| 3053 | MLE Mean (bias corrected)                                                                                                                | 1409   | MLE Sd (bias corrected)                             |   | 1407  |   |   |   |   |   |   |
| 3054 |                                                                                                                                          |        | Approximate Chi Square Value (0.05)                 |   | 50.17 |   |   |   |   |   |   |
| 3055 | Adjusted Level of Significance                                                                                                           | 0.0422 | Adjusted Chi Square Value                           |   | 49.4  |   |   |   |   |   |   |
| 3056 |                                                                                                                                          |        |                                                     |   |       |   |   |   |   |   |   |
| 3057 | <b>Assuming Gamma Distribution</b>                                                                                                       |        |                                                     |   |       |   |   |   |   |   |   |
| 3058 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | 1914   | 95% Adjusted Gamma UCL (use when n<50)              |   | 1944  |   |   |   |   |   |   |
| 3059 |                                                                                                                                          |        |                                                     |   |       |   |   |   |   |   |   |
| 3060 | <b>Lognormal GOF Test</b>                                                                                                                |        |                                                     |   |       |   |   |   |   |   |   |
| 3061 | Shapiro Wilk Test Statistic                                                                                                              | 0.943  | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |       |   |   |   |   |   |   |
| 3062 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.933  | Data appear Lognormal at 5% Significance Level      |   |       |   |   |   |   |   |   |
| 3063 | Lilliefors Test Statistic                                                                                                                | 0.111  | <b>Lilliefors Lognormal GOF Test</b>                |   |       |   |   |   |   |   |   |
| 3064 | 5% Lilliefors Critical Value                                                                                                             | 0.15   | Data appear Lognormal at 5% Significance Level      |   |       |   |   |   |   |   |   |
| 3065 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |        |                                                     |   |       |   |   |   |   |   |   |
| 3066 |                                                                                                                                          |        |                                                     |   |       |   |   |   |   |   |   |
| 3067 | <b>Lognormal Statistics</b>                                                                                                              |        |                                                     |   |       |   |   |   |   |   |   |
| 3068 | Minimum of Logged Data                                                                                                                   | 4.796  | Mean of logged Data                                 |   | 6.719 |   |   |   |   |   |   |
| 3069 | Maximum of Logged Data                                                                                                                   | 8.589  | SD of logged Data                                   |   | 1.091 |   |   |   |   |   |   |
| 3070 |                                                                                                                                          |        |                                                     |   |       |   |   |   |   |   |   |
| 3071 | <b>Assuming Lognormal Distribution</b>                                                                                                   |        |                                                     |   |       |   |   |   |   |   |   |
| 3072 | 95% H-UCL                                                                                                                                | 2443   | 90% Chebyshev (MVUE) UCL                            |   | 2432  |   |   |   |   |   |   |
| 3073 | 95% Chebyshev (MVUE) UCL                                                                                                                 | 2871   | 97.5% Chebyshev (MVUE) UCL                          |   | 3480  |   |   |   |   |   |   |
| 3074 | 99% Chebyshev (MVUE) UCL                                                                                                                 | 4677   |                                                     |   |       |   |   |   |   |   |   |
| 3075 |                                                                                                                                          |        |                                                     |   |       |   |   |   |   |   |   |
| 3076 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |                                                     |   |       |   |   |   |   |   |   |
| 3077 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |        |                                                     |   |       |   |   |   |   |   |   |
| 3078 |                                                                                                                                          |        |                                                     |   |       |   |   |   |   |   |   |
| 3079 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |        |                                                     |   |       |   |   |   |   |   |   |
| 3080 | 95% CLT UCL                                                                                                                              | 1805   | 95% Jackknife UCL                                   |   | 1817  |   |   |   |   |   |   |
| 3081 | 95% Standard Bootstrap UCL                                                                                                               | 1794   | 95% Bootstrap-t UCL                                 |   | 1887  |   |   |   |   |   |   |
| 3082 | 95% Hall's Bootstrap UCL                                                                                                                 | 1865   | 95% Percentile Bootstrap UCL                        |   | 1815  |   |   |   |   |   |   |

| A    | B                                                                                                                                        | C | D | E | F      | G                                                   | H | I | J | K     | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|--------|-----------------------------------------------------|---|---|---|-------|---|
| 3083 | 95% BCA Bootstrap UCL                                                                                                                    |   |   |   | 1849   |                                                     |   |   |   |       |   |
| 3084 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   |   | 2132   | 95% Chebyshev(Mean, Sd) UCL                         |   |   |   | 2460  |   |
| 3085 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   |   | 2914   | 99% Chebyshev(Mean, Sd) UCL                         |   |   |   | 3808  |   |
| 3086 |                                                                                                                                          |   |   |   |        |                                                     |   |   |   |       |   |
| 3087 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |   |        |                                                     |   |   |   |       |   |
| 3088 | 95% H-UCL                                                                                                                                |   |   |   | 2443   |                                                     |   |   |   |       |   |
| 3089 |                                                                                                                                          |   |   |   |        |                                                     |   |   |   |       |   |
| 3090 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |   |        |                                                     |   |   |   |       |   |
| 3091 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |   |        |                                                     |   |   |   |       |   |
| 3092 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |   |        |                                                     |   |   |   |       |   |
| 3093 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |   |        |                                                     |   |   |   |       |   |
| 3094 |                                                                                                                                          |   |   |   |        |                                                     |   |   |   |       |   |
| 3095 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |   |   |   |        |                                                     |   |   |   |       |   |
| 3096 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |   |   |   |        |                                                     |   |   |   |       |   |
| 3097 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |   |   |   |        |                                                     |   |   |   |       |   |
| 3098 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |   |   |   |        |                                                     |   |   |   |       |   |
| 3099 |                                                                                                                                          |   |   |   |        |                                                     |   |   |   |       |   |
| 3100 |                                                                                                                                          |   |   |   |        |                                                     |   |   |   |       |   |
| 3101 | <b>Result (eu2_zinc_waste rock)</b>                                                                                                      |   |   |   |        |                                                     |   |   |   |       |   |
| 3102 |                                                                                                                                          |   |   |   |        |                                                     |   |   |   |       |   |
| 3103 | <b>General Statistics</b>                                                                                                                |   |   |   |        |                                                     |   |   |   |       |   |
| 3104 | Total Number of Observations                                                                                                             |   |   |   | 53     | Number of Distinct Observations                     |   |   |   | 52    |   |
| 3105 |                                                                                                                                          |   |   |   |        | Number of Missing Observations                      |   |   |   | 0     |   |
| 3106 | Minimum                                                                                                                                  |   |   |   | 127    | Mean                                                |   |   |   | 2852  |   |
| 3107 | Maximum                                                                                                                                  |   |   |   | 19900  | Median                                              |   |   |   | 1840  |   |
| 3108 | SD                                                                                                                                       |   |   |   | 3889   | Std. Error of Mean                                  |   |   |   | 534.2 |   |
| 3109 | Coefficient of Variation                                                                                                                 |   |   |   | 1.364  | Skewness                                            |   |   |   | 3.271 |   |
| 3110 |                                                                                                                                          |   |   |   |        |                                                     |   |   |   |       |   |
| 3111 | <b>Normal GOF Test</b>                                                                                                                   |   |   |   |        |                                                     |   |   |   |       |   |
| 3112 | Shapiro Wilk Test Statistic                                                                                                              |   |   |   | 0.567  | <b>Shapiro Wilk GOF Test</b>                        |   |   |   |       |   |
| 3113 | 5% Shapiro Wilk P Value                                                                                                                  |   |   |   | 0      | Data Not Normal at 5% Significance Level            |   |   |   |       |   |
| 3114 | Lilliefors Test Statistic                                                                                                                |   |   |   | 0.309  | <b>Lilliefors GOF Test</b>                          |   |   |   |       |   |
| 3115 | 5% Lilliefors Critical Value                                                                                                             |   |   |   | 0.121  | Data Not Normal at 5% Significance Level            |   |   |   |       |   |
| 3116 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |   |        |                                                     |   |   |   |       |   |
| 3117 |                                                                                                                                          |   |   |   |        |                                                     |   |   |   |       |   |
| 3118 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |   |        |                                                     |   |   |   |       |   |
| 3119 | <b>95% Normal UCL</b>                                                                                                                    |   |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>             |   |   |   |       |   |
| 3120 | 95% Student's-t UCL                                                                                                                      |   |   |   | 3746   | 95% Adjusted-CLT UCL (Chen-1995)                    |   |   |   | 3987  |   |
| 3121 |                                                                                                                                          |   |   |   |        | 95% Modified-t UCL (Johnson-1978)                   |   |   |   | 3786  |   |
| 3122 |                                                                                                                                          |   |   |   |        |                                                     |   |   |   |       |   |
| 3123 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |   |        |                                                     |   |   |   |       |   |
| 3124 | A-D Test Statistic                                                                                                                       |   |   |   | 2.248  | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |   |       |   |
| 3125 | 5% A-D Critical Value                                                                                                                    |   |   |   | 0.778  | Data Not Gamma Distributed at 5% Significance Level |   |   |   |       |   |
| 3126 | K-S Test Statistic                                                                                                                       |   |   |   | 0.181  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |   |       |   |
| 3127 | 5% K-S Critical Value                                                                                                                    |   |   |   | 0.125  | Data Not Gamma Distributed at 5% Significance Level |   |   |   |       |   |
| 3128 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |   |   |        |                                                     |   |   |   |       |   |
| 3129 |                                                                                                                                          |   |   |   |        |                                                     |   |   |   |       |   |
| 3130 | <b>Gamma Statistics</b>                                                                                                                  |   |   |   |        |                                                     |   |   |   |       |   |
| 3131 | k hat (MLE)                                                                                                                              |   |   |   | 1.072  | k star (bias corrected MLE)                         |   |   |   | 1.024 |   |
| 3132 | Theta hat (MLE)                                                                                                                          |   |   |   | 2660   | Theta star (bias corrected MLE)                     |   |   |   | 2785  |   |
| 3133 | nu hat (MLE)                                                                                                                             |   |   |   | 113.6  | nu star (bias corrected)                            |   |   |   | 108.5 |   |
| 3134 | MLE Mean (bias corrected)                                                                                                                |   |   |   | 2852   | MLE Sd (bias corrected)                             |   |   |   | 2818  |   |
| 3135 |                                                                                                                                          |   |   |   |        | Approximate Chi Square Value (0.05)                 |   |   |   | 85.5  |   |
| 3136 | Adjusted Level of Significance                                                                                                           |   |   |   | 0.0455 | Adjusted Chi Square Value                           |   |   |   | 84.93 |   |
| 3137 |                                                                                                                                          |   |   |   |        |                                                     |   |   |   |       |   |
| 3138 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |   |        |                                                     |   |   |   |       |   |
| 3139 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |   |   | 3621   | 95% Adjusted Gamma UCL (use when n<50)              |   |   |   | 3645  |   |
| 3140 |                                                                                                                                          |   |   |   |        |                                                     |   |   |   |       |   |
| 3141 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |   |        |                                                     |   |   |   |       |   |
| 3142 | Shapiro Wilk Test Statistic                                                                                                              |   |   |   | 0.936  | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |   |   |       |   |
| 3143 | 5% Shapiro Wilk P Value                                                                                                                  |   |   |   | 0.0105 | Data Not Lognormal at 5% Significance Level         |   |   |   |       |   |
| 3144 | Lilliefors Test Statistic                                                                                                                |   |   |   | 0.156  | <b>Lilliefors Lognormal GOF Test</b>                |   |   |   |       |   |
| 3145 | 5% Lilliefors Critical Value                                                                                                             |   |   |   | 0.121  | Data Not Lognormal at 5% Significance Level         |   |   |   |       |   |
| 3146 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |   |   |   |        |                                                     |   |   |   |       |   |
| 3147 |                                                                                                                                          |   |   |   |        |                                                     |   |   |   |       |   |
| 3148 | <b>Lognormal Statistics</b>                                                                                                              |   |   |   |        |                                                     |   |   |   |       |   |
| 3149 | Minimum of Logged Data                                                                                                                   |   |   |   | 4.844  | Mean of logged Data                                 |   |   |   | 7.422 |   |

|      | A                                                                                                                                        | B | C | D         | E                                                               | F                 | G | H     | I | J     | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|-----------|-----------------------------------------------------------------|-------------------|---|-------|---|-------|---|---|
| 3150 | Maximum of Logged Data                                                                                                                   |   |   |           | 9.898                                                           | SD of logged Data |   |       |   | 1.042 |   |   |
| 3151 |                                                                                                                                          |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3152 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3153 | 95% H-UCL                                                                                                                                |   |   | 4047      | 90% Chebyshev (MVUE) UCL                                        |                   |   | 4281  |   |       |   |   |
| 3154 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 4937      | 97.5% Chebyshev (MVUE) UCL                                      |                   |   | 5847  |   |       |   |   |
| 3155 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 7636      |                                                                 |                   |   |       |   |       |   |   |
| 3156 |                                                                                                                                          |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3157 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3158 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3159 |                                                                                                                                          |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3160 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3161 | 95% CLT UCL                                                                                                                              |   |   | 3731      | 95% Jackknife UCL                                               |                   |   | 3746  |   |       |   |   |
| 3162 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 3712      | 95% Bootstrap-t UCL                                             |                   |   | 4129  |   |       |   |   |
| 3163 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 4375      | 95% Percentile Bootstrap UCL                                    |                   |   | 3782  |   |       |   |   |
| 3164 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 3997      |                                                                 |                   |   |       |   |       |   |   |
| 3165 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 4454      | 95% Chebyshev(Mean, Sd) UCL                                     |                   |   | 5180  |   |       |   |   |
| 3166 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 6188      | 99% Chebyshev(Mean, Sd) UCL                                     |                   |   | 8167  |   |       |   |   |
| 3167 |                                                                                                                                          |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3168 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3169 | 95% Chebyshev (Mean, Sd) UCL                                                                                                             |   |   | 5180      |                                                                 |                   |   |       |   |       |   |   |
| 3170 |                                                                                                                                          |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3171 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3172 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3173 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3174 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3175 |                                                                                                                                          |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3176 |                                                                                                                                          |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3177 | <b>Result (eu3_antimony_overbank)</b>                                                                                                    |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3178 |                                                                                                                                          |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3179 | <b>General Statistics</b>                                                                                                                |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3180 | Total Number of Observations                                                                                                             |   |   | 62        | Number of Distinct Observations                                 |                   |   | 48    |   |       |   |   |
| 3181 |                                                                                                                                          |   |   |           | Number of Missing Observations                                  |                   |   | 0     |   |       |   |   |
| 3182 | Minimum                                                                                                                                  |   |   | 0.086     | Mean                                                            |                   |   | 2.327 |   |       |   |   |
| 3183 | Maximum                                                                                                                                  |   |   | 7.4       | Median                                                          |                   |   | 1.73  |   |       |   |   |
| 3184 | SD                                                                                                                                       |   |   | 1.783     | Std. Error of Mean                                              |                   |   | 0.226 |   |       |   |   |
| 3185 | Coefficient of Variation                                                                                                                 |   |   | 0.766     | Skewness                                                        |                   |   | 1.254 |   |       |   |   |
| 3186 |                                                                                                                                          |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3187 | <b>Normal GOF Test</b>                                                                                                                   |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3188 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.868     | <b>Shapiro Wilk GOF Test</b>                                    |                   |   |       |   |       |   |   |
| 3189 | 5% Shapiro Wilk P Value                                                                                                                  |   |   | 3.1767E-7 | Data Not Normal at 5% Significance Level                        |                   |   |       |   |       |   |   |
| 3190 | Lilliefors Test Statistic                                                                                                                |   |   | 0.165     | <b>Lilliefors GOF Test</b>                                      |                   |   |       |   |       |   |   |
| 3191 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.112     | Data Not Normal at 5% Significance Level                        |                   |   |       |   |       |   |   |
| 3192 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3193 |                                                                                                                                          |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3194 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3195 | <b>95% Normal UCL</b>                                                                                                                    |   |   |           | <b>95% UCLs (Adjusted for Skewness)</b>                         |                   |   |       |   |       |   |   |
| 3196 | 95% Student's-t UCL                                                                                                                      |   |   | 2.705     | 95% Adjusted-CLT UCL (Chen-1995)                                |                   |   | 2.738 |   |       |   |   |
| 3197 |                                                                                                                                          |   |   |           | 95% Modified-t UCL (Johnson-1978)                               |                   |   | 2.711 |   |       |   |   |
| 3198 |                                                                                                                                          |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3199 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3200 | A-D Test Statistic                                                                                                                       |   |   | 0.327     | <b>Anderson-Darling Gamma GOF Test</b>                          |                   |   |       |   |       |   |   |
| 3201 | 5% A-D Critical Value                                                                                                                    |   |   | 0.766     | Detected data appear Gamma Distributed at 5% Significance Level |                   |   |       |   |       |   |   |
| 3202 | K-S Test Statistic                                                                                                                       |   |   | 0.0744    | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |                   |   |       |   |       |   |   |
| 3203 | 5% K-S Critical Value                                                                                                                    |   |   | 0.115     | Detected data appear Gamma Distributed at 5% Significance Level |                   |   |       |   |       |   |   |
| 3204 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3205 |                                                                                                                                          |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3206 | <b>Gamma Statistics</b>                                                                                                                  |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3207 | k hat (MLE)                                                                                                                              |   |   | 1.742     | k star (bias corrected MLE)                                     |                   |   | 1.668 |   |       |   |   |
| 3208 | Theta hat (MLE)                                                                                                                          |   |   | 1.336     | Theta star (bias corrected MLE)                                 |                   |   | 1.395 |   |       |   |   |
| 3209 | nu hat (MLE)                                                                                                                             |   |   | 216       | nu star (bias corrected)                                        |                   |   | 206.8 |   |       |   |   |
| 3210 | MLE Mean (bias corrected)                                                                                                                |   |   | 2.327     | MLE Sd (bias corrected)                                         |                   |   | 1.802 |   |       |   |   |
| 3211 |                                                                                                                                          |   |   |           | Approximate Chi Square Value (0.05)                             |                   |   | 174.6 |   |       |   |   |
| 3212 | Adjusted Level of Significance                                                                                                           |   |   | 0.0461    | Adjusted Chi Square Value                                       |                   |   | 173.9 |   |       |   |   |
| 3213 |                                                                                                                                          |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3214 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |           |                                                                 |                   |   |       |   |       |   |   |
| 3215 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   |   | 2.757     | 95% Adjusted Gamma UCL (use when n<50)                          |                   |   | 2.769 |   |       |   |   |
| 3216 |                                                                                                                                          |   |   |           |                                                                 |                   |   |       |   |       |   |   |

| A    | B                                                                                                                                        | C | D      | E | F                                                               | G | H | I | J     | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|---|-----------------------------------------------------------------|---|---|---|-------|---|---|
| 3217 | <b>Lognormal GOF Test</b>                                                                                                                |   |        |   |                                                                 |   |   |   |       |   |   |
| 3218 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.959  |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |   |       |   |   |
| 3219 | 5% Shapiro Wilk P Value                                                                                                                  |   | 0.0876 |   | Data appear Lognormal at 5% Significance Level                  |   |   |   |       |   |   |
| 3220 | Lilliefors Test Statistic                                                                                                                |   | 0.105  |   | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |   |       |   |   |
| 3221 | 5% Lilliefors Critical Value                                                                                                             |   | 0.112  |   | Data appear Lognormal at 5% Significance Level                  |   |   |   |       |   |   |
| 3222 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |        |   |                                                                 |   |   |   |       |   |   |
| 3223 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 3224 | <b>Lognormal Statistics</b>                                                                                                              |   |        |   |                                                                 |   |   |   |       |   |   |
| 3225 | Minimum of Logged Data                                                                                                                   |   | -2.453 |   | Mean of logged Data                                             |   |   |   | 0.531 |   |   |
| 3226 | Maximum of Logged Data                                                                                                                   |   | 2.001  |   | SD of logged Data                                               |   |   |   | 0.87  |   |   |
| 3227 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 3228 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |        |   |                                                                 |   |   |   |       |   |   |
| 3229 | 95% H-UCL                                                                                                                                |   | 3.156  |   | 90% Chebyshev (MVUE) UCL                                        |   |   |   | 3.397 |   |   |
| 3230 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 3.821  |   | 97.5% Chebyshev (MVUE) UCL                                      |   |   |   | 4.409 |   |   |
| 3231 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 5.563  |   |                                                                 |   |   |   |       |   |   |
| 3232 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 3233 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |        |   |                                                                 |   |   |   |       |   |   |
| 3234 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |        |   |                                                                 |   |   |   |       |   |   |
| 3235 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 3236 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |        |   |                                                                 |   |   |   |       |   |   |
| 3237 | 95% CLT UCL                                                                                                                              |   | 2.699  |   | 95% Jackknife UCL                                               |   |   |   | 2.705 |   |   |
| 3238 | 95% Standard Bootstrap UCL                                                                                                               |   | 2.704  |   | 95% Bootstrap-t UCL                                             |   |   |   | 2.773 |   |   |
| 3239 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 2.735  |   | 95% Percentile Bootstrap UCL                                    |   |   |   | 2.71  |   |   |
| 3240 | 95% BCA Bootstrap UCL                                                                                                                    |   | 2.739  |   |                                                                 |   |   |   |       |   |   |
| 3241 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 3.006  |   | 95% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 3.314 |   |   |
| 3242 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 3.741  |   | 99% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 4.58  |   |   |
| 3243 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 3244 | <b>Suggested UCL to Use</b>                                                                                                              |   |        |   |                                                                 |   |   |   |       |   |   |
| 3245 | 95% Approximate Gamma UCL                                                                                                                |   | 2.757  |   |                                                                 |   |   |   |       |   |   |
| 3246 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 3247 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |   |                                                                 |   |   |   |       |   |   |
| 3248 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |   |                                                                 |   |   |   |       |   |   |
| 3249 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |   |                                                                 |   |   |   |       |   |   |
| 3250 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |   |                                                                 |   |   |   |       |   |   |
| 3251 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 3252 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 3253 | <b>Result (eu3_antimony_waste rock)</b>                                                                                                  |   |        |   |                                                                 |   |   |   |       |   |   |
| 3254 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 3255 | <b>General Statistics</b>                                                                                                                |   |        |   |                                                                 |   |   |   |       |   |   |
| 3256 | Total Number of Observations                                                                                                             |   | 14     |   | Number of Distinct Observations                                 |   |   |   | 14    |   |   |
| 3257 |                                                                                                                                          |   |        |   | Number of Missing Observations                                  |   |   |   | 0     |   |   |
| 3258 | Minimum                                                                                                                                  |   | 0.81   |   | Mean                                                            |   |   |   | 21.27 |   |   |
| 3259 | Maximum                                                                                                                                  |   | 65.8   |   | Median                                                          |   |   |   | 10.1  |   |   |
| 3260 | SD                                                                                                                                       |   | 24.37  |   | Std. Error of Mean                                              |   |   |   | 6.513 |   |   |
| 3261 | Coefficient of Variation                                                                                                                 |   | 1.146  |   | Skewness                                                        |   |   |   | 1.126 |   |   |
| 3262 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 3263 | <b>Normal GOF Test</b>                                                                                                                   |   |        |   |                                                                 |   |   |   |       |   |   |
| 3264 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.773  |   | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |       |   |   |
| 3265 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.874  |   | Data Not Normal at 5% Significance Level                        |   |   |   |       |   |   |
| 3266 | Lilliefors Test Statistic                                                                                                                |   | 0.276  |   | <b>Lilliefors GOF Test</b>                                      |   |   |   |       |   |   |
| 3267 | 5% Lilliefors Critical Value                                                                                                             |   | 0.226  |   | Data Not Normal at 5% Significance Level                        |   |   |   |       |   |   |
| 3268 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 3269 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 3270 | <b>Assuming Normal Distribution</b>                                                                                                      |   |        |   |                                                                 |   |   |   |       |   |   |
| 3271 | <b>95% Normal UCL</b>                                                                                                                    |   |        |   | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |   |       |   |   |
| 3272 | 95% Student's-t UCL                                                                                                                      |   | 32.8   |   | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |   | 34.07 |   |   |
| 3273 |                                                                                                                                          |   |        |   | 95% Modified-t UCL (Johnson-1978)                               |   |   |   | 33.13 |   |   |
| 3274 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 3275 | <b>Gamma GOF Test</b>                                                                                                                    |   |        |   |                                                                 |   |   |   |       |   |   |
| 3276 | A-D Test Statistic                                                                                                                       |   | 0.412  |   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |   |       |   |   |
| 3277 | 5% A-D Critical Value                                                                                                                    |   | 0.771  |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |       |   |   |
| 3278 | K-S Test Statistic                                                                                                                       |   | 0.144  |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |   |       |   |   |
| 3279 | 5% K-S Critical Value                                                                                                                    |   | 0.238  |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |       |   |   |
| 3280 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |        |   |                                                                 |   |   |   |       |   |   |
| 3281 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |       |   |   |
| 3282 | <b>Gamma Statistics</b>                                                                                                                  |   |        |   |                                                                 |   |   |   |       |   |   |
| 3283 | k hat (MLE)                                                                                                                              |   | 0.742  |   | k star (bias corrected MLE)                                     |   |   |   | 0.631 |   |   |



|      | A                                                                                                                                        | B | C      | D                                                               | E | F     | G | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|-----------------------------------------------------------------|---|-------|---|---|---|---|---|---|
| 3351 | <b>Gamma GOF Test</b>                                                                                                                    |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3352 | A-D Test Statistic                                                                                                                       |   | 0.322  | <b>Anderson-Darling Gamma GOF Test</b>                          |   |       |   |   |   |   |   |   |
| 3353 | 5% A-D Critical Value                                                                                                                    |   | 0.753  | Detected data appear Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |   |   |
| 3354 | K-S Test Statistic                                                                                                                       |   | 0.0702 | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |       |   |   |   |   |   |   |
| 3355 | 5% K-S Critical Value                                                                                                                    |   | 0.114  | Detected data appear Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |   |   |
| 3356 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3357 |                                                                                                                                          |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3358 | <b>Gamma Statistics</b>                                                                                                                  |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3359 | k hat (MLE)                                                                                                                              |   | 4.794  | k star (bias corrected MLE)                                     |   | 4.569 |   |   |   |   |   |   |
| 3360 | Theta hat (MLE)                                                                                                                          |   | 7.909  | Theta star (bias corrected MLE)                                 |   | 8.299 |   |   |   |   |   |   |
| 3361 | nu hat (MLE)                                                                                                                             |   | 584.9  | nu star (bias corrected)                                        |   | 557.4 |   |   |   |   |   |   |
| 3362 | MLE Mean (bias corrected)                                                                                                                |   | 37.92  | MLE Sd (bias corrected)                                         |   | 17.74 |   |   |   |   |   |   |
| 3363 |                                                                                                                                          |   |        | Approximate Chi Square Value (0.05)                             |   | 503.7 |   |   |   |   |   |   |
| 3364 | Adjusted Level of Significance                                                                                                           |   | 0.0461 | Adjusted Chi Square Value                                       |   | 502.5 |   |   |   |   |   |   |
| 3365 |                                                                                                                                          |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3366 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3367 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   | 41.97  | 95% Adjusted Gamma UCL (use when n<50)                          |   | 42.07 |   |   |   |   |   |   |
| 3368 |                                                                                                                                          |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3369 | <b>Lognormal GOF Test</b>                                                                                                                |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3370 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.948  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |       |   |   |   |   |   |   |
| 3371 | 5% Shapiro Wilk P Value                                                                                                                  |   | 0.0223 | Data Not Lognormal at 5% Significance Level                     |   |       |   |   |   |   |   |   |
| 3372 | Lilliefors Test Statistic                                                                                                                |   | 0.103  | <b>Lilliefors Lognormal GOF Test</b>                            |   |       |   |   |   |   |   |   |
| 3373 | 5% Lilliefors Critical Value                                                                                                             |   | 0.113  | Data appear Lognormal at 5% Significance Level                  |   |       |   |   |   |   |   |   |
| 3374 | <b>Data appear Approximate Lognormal at 5% Significance Level</b>                                                                        |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3375 |                                                                                                                                          |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3376 | <b>Lognormal Statistics</b>                                                                                                              |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3377 | Minimum of Logged Data                                                                                                                   |   | 1.988  | Mean of logged Data                                             |   | 3.528 |   |   |   |   |   |   |
| 3378 | Maximum of Logged Data                                                                                                                   |   | 4.428  | SD of logged Data                                               |   | 0.5   |   |   |   |   |   |   |
| 3379 |                                                                                                                                          |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3380 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3381 | 95% H-UCL                                                                                                                                |   | 43.51  | 90% Chebyshev (MVUE) UCL                                        |   | 46.28 |   |   |   |   |   |   |
| 3382 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 49.81  | 97.5% Chebyshev (MVUE) UCL                                      |   | 54.7  |   |   |   |   |   |   |
| 3383 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 64.32  |                                                                 |   |       |   |   |   |   |   |   |
| 3384 |                                                                                                                                          |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3385 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3386 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3387 |                                                                                                                                          |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3388 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3389 | 95% CLT UCL                                                                                                                              |   | 41.4   | 95% Jackknife UCL                                               |   | 41.45 |   |   |   |   |   |   |
| 3390 | 95% Standard Bootstrap UCL                                                                                                               |   | 41.3   | 95% Bootstrap-t UCL                                             |   | 41.42 |   |   |   |   |   |   |
| 3391 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 41.77  | 95% Percentile Bootstrap UCL                                    |   | 41.49 |   |   |   |   |   |   |
| 3392 | 95% BCA Bootstrap UCL                                                                                                                    |   | 41.8   |                                                                 |   |       |   |   |   |   |   |   |
| 3393 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 44.26  | 95% Chebyshev(Mean, Sd) UCL                                     |   | 47.13 |   |   |   |   |   |   |
| 3394 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 51.12  | 99% Chebyshev(Mean, Sd) UCL                                     |   | 58.95 |   |   |   |   |   |   |
| 3395 |                                                                                                                                          |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3396 | <b>Suggested UCL to Use</b>                                                                                                              |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3397 | 95% Student's-t UCL                                                                                                                      |   | 41.45  |                                                                 |   |       |   |   |   |   |   |   |
| 3398 |                                                                                                                                          |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3399 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3400 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3401 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3402 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3403 |                                                                                                                                          |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3404 |                                                                                                                                          |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3405 | <b>Result (eu3_arsenic_waste rock)</b>                                                                                                   |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3406 |                                                                                                                                          |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3407 | <b>General Statistics</b>                                                                                                                |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3408 | Total Number of Observations                                                                                                             |   | 14     | Number of Distinct Observations                                 |   | 14    |   |   |   |   |   |   |
| 3409 |                                                                                                                                          |   |        | Number of Missing Observations                                  |   | 0     |   |   |   |   |   |   |
| 3410 | Minimum                                                                                                                                  |   | 22.8   | Mean                                                            |   | 80.23 |   |   |   |   |   |   |
| 3411 | Maximum                                                                                                                                  |   | 223    | Median                                                          |   | 71.6  |   |   |   |   |   |   |
| 3412 | SD                                                                                                                                       |   | 55.63  | Std. Error of Mean                                              |   | 14.87 |   |   |   |   |   |   |
| 3413 | Coefficient of Variation                                                                                                                 |   | 0.693  | Skewness                                                        |   | 1.338 |   |   |   |   |   |   |
| 3414 |                                                                                                                                          |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3415 | <b>Normal GOF Test</b>                                                                                                                   |   |        |                                                                 |   |       |   |   |   |   |   |   |
| 3416 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.879  | <b>Shapiro Wilk GOF Test</b>                                    |   |       |   |   |   |   |   |   |
| 3417 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.874  | Data appear Normal at 5% Significance Level                     |   |       |   |   |   |   |   |   |

| A    | B                                                                                                                                        | C | D | E      | F                                                               | G | H | I | J     | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------------------|---|---|---|-------|---|---|--|
| 3418 | Lilliefors Test Statistic                                                                                                                |   |   | 0.151  | Lilliefors GOF Test                                             |   |   |   |       |   |   |  |
| 3419 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.226  | Data appear Normal at 5% Significance Level                     |   |   |   |       |   |   |  |
| 3420 | Data appear Normal at 5% Significance Level                                                                                              |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3421 |                                                                                                                                          |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3422 | Assuming Normal Distribution                                                                                                             |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3423 | 95% Normal UCL                                                                                                                           |   |   |        | 95% UCLs (Adjusted for Skewness)                                |   |   |   |       |   |   |  |
| 3424 | 95% Student's-t UCL                                                                                                                      |   |   | 106.6  | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |   | 110.4 |   |   |  |
| 3425 |                                                                                                                                          |   |   |        | 95% Modified-t UCL (Johnson-1978)                               |   |   |   | 107.4 |   |   |  |
| 3426 |                                                                                                                                          |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3427 | Gamma GOF Test                                                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3428 | A-D Test Statistic                                                                                                                       |   |   | 0.245  | Anderson-Darling Gamma GOF Test                                 |   |   |   |       |   |   |  |
| 3429 | 5% A-D Critical Value                                                                                                                    |   |   | 0.744  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |       |   |   |  |
| 3430 | K-S Test Statistic                                                                                                                       |   |   | 0.114  | Kolmogorov-Smirnov Gamma GOF Test                               |   |   |   |       |   |   |  |
| 3431 | 5% K-S Critical Value                                                                                                                    |   |   | 0.231  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |       |   |   |  |
| 3432 | Detected data appear Gamma Distributed at 5% Significance Level                                                                          |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3433 |                                                                                                                                          |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3434 | Gamma Statistics                                                                                                                         |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3435 | k hat (MLE)                                                                                                                              |   |   | 2.452  | k star (bias corrected MLE)                                     |   |   |   | 1.974 |   |   |  |
| 3436 | Theta hat (MLE)                                                                                                                          |   |   | 32.72  | Theta star (bias corrected MLE)                                 |   |   |   | 40.64 |   |   |  |
| 3437 | nu hat (MLE)                                                                                                                             |   |   | 68.65  | nu star (bias corrected)                                        |   |   |   | 55.27 |   |   |  |
| 3438 | MLE Mean (bias corrected)                                                                                                                |   |   | 80.23  | MLE Sd (bias corrected)                                         |   |   |   | 57.1  |   |   |  |
| 3439 |                                                                                                                                          |   |   |        | Approximate Chi Square Value (0.05)                             |   |   |   | 39.19 |   |   |  |
| 3440 | Adjusted Level of Significance                                                                                                           |   |   | 0.0312 | Adjusted Chi Square Value                                       |   |   |   | 37.39 |   |   |  |
| 3441 |                                                                                                                                          |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3442 | Assuming Gamma Distribution                                                                                                              |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3443 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |   | 113.2  | 95% Adjusted Gamma UCL (use when n<50)                          |   |   |   | 118.6 |   |   |  |
| 3444 |                                                                                                                                          |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3445 | Lognormal GOF Test                                                                                                                       |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3446 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.962  | Shapiro Wilk Lognormal GOF Test                                 |   |   |   |       |   |   |  |
| 3447 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.874  | Data appear Lognormal at 5% Significance Level                  |   |   |   |       |   |   |  |
| 3448 | Lilliefors Test Statistic                                                                                                                |   |   | 0.12   | Lilliefors Lognormal GOF Test                                   |   |   |   |       |   |   |  |
| 3449 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.226  | Data appear Lognormal at 5% Significance Level                  |   |   |   |       |   |   |  |
| 3450 | Data appear Lognormal at 5% Significance Level                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3451 |                                                                                                                                          |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3452 | Lognormal Statistics                                                                                                                     |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3453 | Minimum of Logged Data                                                                                                                   |   |   | 3.127  | Mean of logged Data                                             |   |   |   | 4.167 |   |   |  |
| 3454 | Maximum of Logged Data                                                                                                                   |   |   | 5.407  | SD of logged Data                                               |   |   |   | 0.696 |   |   |  |
| 3455 |                                                                                                                                          |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3456 | Assuming Lognormal Distribution                                                                                                          |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3457 | 95% H-UCL                                                                                                                                |   |   | 128.9  | 90% Chebyshev (MVUE) UCL                                        |   |   |   | 127.7 |   |   |  |
| 3458 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 149.1  | 97.5% Chebyshev (MVUE) UCL                                      |   |   |   | 178.7 |   |   |  |
| 3459 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 237    |                                                                 |   |   |   |       |   |   |  |
| 3460 |                                                                                                                                          |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3461 | Nonparametric Distribution Free UCL Statistics                                                                                           |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3462 | Data appear to follow a Discernible Distribution at 5% Significance Level                                                                |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3463 |                                                                                                                                          |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3464 | Nonparametric Distribution Free UCLs                                                                                                     |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3465 | 95% CLT UCL                                                                                                                              |   |   | 104.7  | 95% Jackknife UCL                                               |   |   |   | 106.6 |   |   |  |
| 3466 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 103.3  | 95% Bootstrap-t UCL                                             |   |   |   | 115.8 |   |   |  |
| 3467 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 119.6  | 95% Percentile Bootstrap UCL                                    |   |   |   | 104.6 |   |   |  |
| 3468 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 109.8  |                                                                 |   |   |   |       |   |   |  |
| 3469 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 124.8  | 95% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 145   |   |   |  |
| 3470 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 173.1  | 99% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 228.2 |   |   |  |
| 3471 |                                                                                                                                          |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3472 | Suggested UCL to Use                                                                                                                     |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3473 | 95% Student's-t UCL                                                                                                                      |   |   | 106.6  |                                                                 |   |   |   |       |   |   |  |
| 3474 |                                                                                                                                          |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3475 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3476 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3477 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3478 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3479 |                                                                                                                                          |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3480 | Result (eu3_cadmium_overbank)                                                                                                            |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3481 |                                                                                                                                          |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3482 | General Statistics                                                                                                                       |   |   |        |                                                                 |   |   |   |       |   |   |  |
| 3483 | Total Number of Observations                                                                                                             |   |   | 62     | Number of Distinct Observations                                 |   |   |   | 48    |   |   |  |
| 3484 | Number of Detects                                                                                                                        |   |   | 43     | Number of Non-Detects                                           |   |   |   | 19    |   |   |  |

|      | A                                                                                                                         | B | C | D      | E                                                            | F | G | H      | I | J | K | L |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|--------|--------------------------------------------------------------|---|---|--------|---|---|---|---|
| 3485 | Number of Distinct Detects                                                                                                |   |   | 37     | Number of Distinct Non-Detects                               |   |   | 11     |   |   |   |   |
| 3486 | Minimum Detect                                                                                                            |   |   | 0.11   | Minimum Non-Detect                                           |   |   | 0.045  |   |   |   |   |
| 3487 | Maximum Detect                                                                                                            |   |   | 54.5   | Maximum Non-Detect                                           |   |   | 0.061  |   |   |   |   |
| 3488 | Variance Detects                                                                                                          |   |   | 72.02  | Percent Non-Detects                                          |   |   | 30.65% |   |   |   |   |
| 3489 | Mean Detects                                                                                                              |   |   | 3.676  | SD Detects                                                   |   |   | 8.486  |   |   |   |   |
| 3490 | Median Detects                                                                                                            |   |   | 1.8    | CV Detects                                                   |   |   | 2.309  |   |   |   |   |
| 3491 | Skewness Detects                                                                                                          |   |   | 5.479  | Kurtosis Detects                                             |   |   | 32.37  |   |   |   |   |
| 3492 | Mean of Logged Detects                                                                                                    |   |   | 0.502  | SD of Logged Detects                                         |   |   | 1.177  |   |   |   |   |
| 3493 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3494 | <b>Normal GOF Test on Detects Only</b>                                                                                    |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3495 | Shapiro Wilk Test Statistic                                                                                               |   |   | 0.363  | Shapiro Wilk GOF Test                                        |   |   |        |   |   |   |   |
| 3496 | 5% Shapiro Wilk Critical Value                                                                                            |   |   | 0.943  | Detected Data Not Normal at 5% Significance Level            |   |   |        |   |   |   |   |
| 3497 | Lilliefors Test Statistic                                                                                                 |   |   | 0.35   | Lilliefors GOF Test                                          |   |   |        |   |   |   |   |
| 3498 | 5% Lilliefors Critical Value                                                                                              |   |   | 0.134  | Detected Data Not Normal at 5% Significance Level            |   |   |        |   |   |   |   |
| 3499 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                  |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3500 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3501 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3502 | KM Mean                                                                                                                   |   |   | 2.563  | KM Standard Error of Mean                                    |   |   | 0.923  |   |   |   |   |
| 3503 | KM SD                                                                                                                     |   |   | 7.182  | 95% KM (BCA) UCL                                             |   |   | 4.464  |   |   |   |   |
| 3504 | 95% KM (t) UCL                                                                                                            |   |   | 4.105  | 95% KM (Percentile Bootstrap) UCL                            |   |   | 4.222  |   |   |   |   |
| 3505 | 95% KM (z) UCL                                                                                                            |   |   | 4.081  | 95% KM Bootstrap t UCL                                       |   |   | 7.777  |   |   |   |   |
| 3506 | 90% KM Chebyshev UCL                                                                                                      |   |   | 5.332  | 95% KM Chebyshev UCL                                         |   |   | 6.586  |   |   |   |   |
| 3507 | 97.5% KM Chebyshev UCL                                                                                                    |   |   | 8.327  | 99% KM Chebyshev UCL                                         |   |   | 11.75  |   |   |   |   |
| 3508 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3509 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3510 | A-D Test Statistic                                                                                                        |   |   | 2.413  | Anderson-Darling GOF Test                                    |   |   |        |   |   |   |   |
| 3511 | 5% A-D Critical Value                                                                                                     |   |   | 0.79   | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |        |   |   |   |   |
| 3512 | K-S Test Statistic                                                                                                        |   |   | 0.201  | Kolmogorov-Smirnov GOF                                       |   |   |        |   |   |   |   |
| 3513 | 5% K-S Critical Value                                                                                                     |   |   | 0.14   | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |        |   |   |   |   |
| 3514 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                       |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3515 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3516 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3517 | k hat (MLE)                                                                                                               |   |   | 0.748  | k star (bias corrected MLE)                                  |   |   | 0.712  |   |   |   |   |
| 3518 | Theta hat (MLE)                                                                                                           |   |   | 4.912  | Theta star (bias corrected MLE)                              |   |   | 5.165  |   |   |   |   |
| 3519 | nu hat (MLE)                                                                                                              |   |   | 64.36  | nu star (bias corrected)                                     |   |   | 61.2   |   |   |   |   |
| 3520 | Mean (detects)                                                                                                            |   |   | 3.676  |                                                              |   |   |        |   |   |   |   |
| 3521 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3522 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3523 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3524 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3525 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3526 | This is especially true when the sample size is small.                                                                    |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3527 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3528 | Minimum                                                                                                                   |   |   | 0.01   | Mean                                                         |   |   | 2.552  |   |   |   |   |
| 3529 | Maximum                                                                                                                   |   |   | 54.5   | Median                                                       |   |   | 1.05   |   |   |   |   |
| 3530 | SD                                                                                                                        |   |   | 7.245  | CV                                                           |   |   | 2.838  |   |   |   |   |
| 3531 | k hat (MLE)                                                                                                               |   |   | 0.338  | k star (bias corrected MLE)                                  |   |   | 0.332  |   |   |   |   |
| 3532 | Theta hat (MLE)                                                                                                           |   |   | 7.55   | Theta star (bias corrected MLE)                              |   |   | 7.677  |   |   |   |   |
| 3533 | nu hat (MLE)                                                                                                              |   |   | 41.92  | nu star (bias corrected)                                     |   |   | 41.22  |   |   |   |   |
| 3534 | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   | 0.0461 |                                                              |   |   |        |   |   |   |   |
| 3535 | Approximate Chi Square Value (41.22, $\alpha$ )                                                                           |   |   | 27.51  | Adjusted Chi Square Value (41.22, $\beta$ )                  |   |   | 27.24  |   |   |   |   |
| 3536 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   | 3.825  | 95% Gamma Adjusted UCL (use when $n < 50$ )                  |   |   | 3.862  |   |   |   |   |
| 3537 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3538 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3539 | Mean (KM)                                                                                                                 |   |   | 2.563  | SD (KM)                                                      |   |   | 7.182  |   |   |   |   |
| 3540 | Variance (KM)                                                                                                             |   |   | 51.59  | SE of Mean (KM)                                              |   |   | 0.923  |   |   |   |   |
| 3541 | k hat (KM)                                                                                                                |   |   | 0.127  | k star (KM)                                                  |   |   | 0.132  |   |   |   |   |
| 3542 | nu hat (KM)                                                                                                               |   |   | 15.79  | nu star (KM)                                                 |   |   | 16.36  |   |   |   |   |
| 3543 | theta hat (KM)                                                                                                            |   |   | 20.13  | theta star (KM)                                              |   |   | 19.43  |   |   |   |   |
| 3544 | 80% gamma percentile (KM)                                                                                                 |   |   | 2.485  | 90% gamma percentile (KM)                                    |   |   | 7.432  |   |   |   |   |
| 3545 | 95% gamma percentile (KM)                                                                                                 |   |   | 14.43  | 99% gamma percentile (KM)                                    |   |   | 35.31  |   |   |   |   |
| 3546 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3547 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3548 | Approximate Chi Square Value (16.36, $\alpha$ )                                                                           |   |   | 8.217  | Adjusted Chi Square Value (16.36, $\beta$ )                  |   |   | 8.079  |   |   |   |   |
| 3549 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   |   | 5.103  | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )               |   |   | 5.19   |   |   |   |   |
| 3550 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3551 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |        |                                                              |   |   |        |   |   |   |   |

|      | A                                                                                                                                        | B | C | D | E      | F                                                               | G | H | I | J      | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|--------|-----------------------------------------------------------------|---|---|---|--------|---|---|--|
| 3552 | Shapiro Wilk Test Statistic                                                                                                              |   |   |   | 0.956  | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |        |   |   |  |
| 3553 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   |   | 0.943  | Detected Data appear Lognormal at 5% Significance Level         |   |   |   |        |   |   |  |
| 3554 | Lilliefors Test Statistic                                                                                                                |   |   |   | 0.115  | <b>Lilliefors GOF Test</b>                                      |   |   |   |        |   |   |  |
| 3555 | 5% Lilliefors Critical Value                                                                                                             |   |   |   | 0.134  | Detected Data appear Lognormal at 5% Significance Level         |   |   |   |        |   |   |  |
| 3556 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                           |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3557 |                                                                                                                                          |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3558 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3559 | Mean in Original Scale                                                                                                                   |   |   |   | 2.59   | Mean in Log Scale                                               |   |   |   | -0.289 |   |   |  |
| 3560 | SD in Original Scale                                                                                                                     |   |   |   | 7.232  | SD in Log Scale                                                 |   |   |   | 1.56   |   |   |  |
| 3561 | 95% t UCL (assumes normality of ROS data)                                                                                                |   |   |   | 4.124  | 95% Percentile Bootstrap UCL                                    |   |   |   | 4.394  |   |   |  |
| 3562 | 95% BCA Bootstrap UCL                                                                                                                    |   |   |   | 5.484  | 95% Bootstrap t UCL                                             |   |   |   | 8.326  |   |   |  |
| 3563 | 95% H-UCL (Log ROS)                                                                                                                      |   |   |   | 4.236  |                                                                 |   |   |   |        |   |   |  |
| 3564 |                                                                                                                                          |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3565 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3566 | KM Mean (logged)                                                                                                                         |   |   |   | -0.602 | KM Geo Mean                                                     |   |   |   | 0.547  |   |   |  |
| 3567 | KM SD (logged)                                                                                                                           |   |   |   | 1.923  | 95% Critical H Value (KM-Log)                                   |   |   |   | 3.012  |   |   |  |
| 3568 | KM Standard Error of Mean (logged)                                                                                                       |   |   |   | 0.247  | 95% H-UCL (KM -Log)                                             |   |   |   | 7.297  |   |   |  |
| 3569 | KM SD (logged)                                                                                                                           |   |   |   | 1.923  | 95% Critical H Value (KM-Log)                                   |   |   |   | 3.012  |   |   |  |
| 3570 | KM Standard Error of Mean (logged)                                                                                                       |   |   |   | 0.247  |                                                                 |   |   |   |        |   |   |  |
| 3571 |                                                                                                                                          |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3572 | <b>DL/2 Statistics</b>                                                                                                                   |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3573 | <b>DL/2 Normal</b>                                                                                                                       |   |   |   |        | <b>DL/2 Log-Transformed</b>                                     |   |   |   |        |   |   |  |
| 3574 | Mean in Original Scale                                                                                                                   |   |   |   | 2.557  | Mean in Log Scale                                               |   |   |   | -0.777 |   |   |  |
| 3575 | SD in Original Scale                                                                                                                     |   |   |   | 7.243  | SD in Log Scale                                                 |   |   |   | 2.172  |   |   |  |
| 3576 | 95% t UCL (Assumes normality)                                                                                                            |   |   |   | 4.094  | 95% H-Stat UCL                                                  |   |   |   | 12.03  |   |   |  |
| 3577 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3578 |                                                                                                                                          |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3579 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3580 | <b>Detected Data appear Lognormal Distributed at 5% Significance Level</b>                                                               |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3581 |                                                                                                                                          |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3582 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3583 | KM H-UCL                                                                                                                                 |   |   |   | 7.297  |                                                                 |   |   |   |        |   |   |  |
| 3584 |                                                                                                                                          |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3585 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3586 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3587 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3588 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3589 |                                                                                                                                          |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3590 |                                                                                                                                          |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3591 | <b>Result (eu3_cadmium_waste rock)</b>                                                                                                   |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3592 |                                                                                                                                          |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3593 | <b>General Statistics</b>                                                                                                                |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3594 | Total Number of Observations                                                                                                             |   |   |   | 14     | Number of Distinct Observations                                 |   |   |   | 14     |   |   |  |
| 3595 |                                                                                                                                          |   |   |   |        | Number of Missing Observations                                  |   |   |   | 0      |   |   |  |
| 3596 | Minimum                                                                                                                                  |   |   |   | 0.15   | Mean                                                            |   |   |   | 6.295  |   |   |  |
| 3597 | Maximum                                                                                                                                  |   |   |   | 20.7   | Median                                                          |   |   |   | 3.9    |   |   |  |
| 3598 | SD                                                                                                                                       |   |   |   | 7.312  | Std. Error of Mean                                              |   |   |   | 1.954  |   |   |  |
| 3599 | Coefficient of Variation                                                                                                                 |   |   |   | 1.162  | Skewness                                                        |   |   |   | 1.214  |   |   |  |
| 3600 |                                                                                                                                          |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3601 | <b>Normal GOF Test</b>                                                                                                                   |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3602 | Shapiro Wilk Test Statistic                                                                                                              |   |   |   | 0.788  | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |        |   |   |  |
| 3603 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   |   | 0.874  | Data Not Normal at 5% Significance Level                        |   |   |   |        |   |   |  |
| 3604 | Lilliefors Test Statistic                                                                                                                |   |   |   | 0.274  | <b>Lilliefors GOF Test</b>                                      |   |   |   |        |   |   |  |
| 3605 | 5% Lilliefors Critical Value                                                                                                             |   |   |   | 0.226  | Data Not Normal at 5% Significance Level                        |   |   |   |        |   |   |  |
| 3606 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3607 |                                                                                                                                          |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3608 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3609 | <b>95% Normal UCL</b>                                                                                                                    |   |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |   |        |   |   |  |
| 3610 | 95% Student's-t UCL                                                                                                                      |   |   |   | 9.756  | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |   | 10.19  |   |   |  |
| 3611 |                                                                                                                                          |   |   |   |        | 95% Modified-t UCL (Johnson-1978)                               |   |   |   | 9.861  |   |   |  |
| 3612 |                                                                                                                                          |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3613 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |   |        |                                                                 |   |   |   |        |   |   |  |
| 3614 | A-D Test Statistic                                                                                                                       |   |   |   | 0.313  | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |   |        |   |   |  |
| 3615 | 5% A-D Critical Value                                                                                                                    |   |   |   | 0.776  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |        |   |   |  |
| 3616 | K-S Test Statistic                                                                                                                       |   |   |   | 0.156  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |   |        |   |   |  |
| 3617 | 5% K-S Critical Value                                                                                                                    |   |   |   | 0.239  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |        |   |   |  |
| 3618 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |   |        |                                                                 |   |   |   |        |   |   |  |

|      | A                                                                                                                                        | B | C      | D | E                                              | F | G     | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|---|------------------------------------------------|---|-------|---|---|---|---|---|
| 3619 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |   |
| 3620 | <b>Gamma Statistics</b>                                                                                                                  |   |        |   |                                                |   |       |   |   |   |   |   |
| 3621 | k hat (MLE)                                                                                                                              |   | 0.686  |   | k star (bias corrected MLE)                    |   | 0.586 |   |   |   |   |   |
| 3622 | Theta hat (MLE)                                                                                                                          |   | 9.179  |   | Theta star (bias corrected MLE)                |   | 10.73 |   |   |   |   |   |
| 3623 | nu hat (MLE)                                                                                                                             |   | 19.2   |   | nu star (bias corrected)                       |   | 16.42 |   |   |   |   |   |
| 3624 | MLE Mean (bias corrected)                                                                                                                |   | 6.295  |   | MLE Sd (bias corrected)                        |   | 8.22  |   |   |   |   |   |
| 3625 |                                                                                                                                          |   |        |   | Approximate Chi Square Value (0.05)            |   | 8.26  |   |   |   |   |   |
| 3626 | Adjusted Level of Significance                                                                                                           |   | 0.0312 |   | Adjusted Chi Square Value                      |   | 7.503 |   |   |   |   |   |
| 3627 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |   |
| 3628 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |        |   |                                                |   |       |   |   |   |   |   |
| 3629 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   | 12.51  |   | 95% Adjusted Gamma UCL (use when n<50)         |   | 13.78 |   |   |   |   |   |
| 3630 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |   |
| 3631 | <b>Lognormal GOF Test</b>                                                                                                                |   |        |   |                                                |   |       |   |   |   |   |   |
| 3632 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.945  |   | <b>Shapiro Wilk Lognormal GOF Test</b>         |   |       |   |   |   |   |   |
| 3633 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.874  |   | Data appear Lognormal at 5% Significance Level |   |       |   |   |   |   |   |
| 3634 | Lilliefors Test Statistic                                                                                                                |   | 0.145  |   | <b>Lilliefors Lognormal GOF Test</b>           |   |       |   |   |   |   |   |
| 3635 | 5% Lilliefors Critical Value                                                                                                             |   | 0.226  |   | Data appear Lognormal at 5% Significance Level |   |       |   |   |   |   |   |
| 3636 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |        |   |                                                |   |       |   |   |   |   |   |
| 3637 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |   |
| 3638 | <b>Lognormal Statistics</b>                                                                                                              |   |        |   |                                                |   |       |   |   |   |   |   |
| 3639 | Minimum of Logged Data                                                                                                                   |   | -1.897 |   | Mean of logged Data                            |   | 0.956 |   |   |   |   |   |
| 3640 | Maximum of Logged Data                                                                                                                   |   | 3.03   |   | SD of logged Data                              |   | 1.592 |   |   |   |   |   |
| 3641 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |   |
| 3642 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |        |   |                                                |   |       |   |   |   |   |   |
| 3643 | 95% H-UCL                                                                                                                                |   | 50.91  |   | 90% Chebyshev (MVUE) UCL                       |   | 19.06 |   |   |   |   |   |
| 3644 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 24.15  |   | 97.5% Chebyshev (MVUE) UCL                     |   | 31.23 |   |   |   |   |   |
| 3645 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 45.13  |   |                                                |   |       |   |   |   |   |   |
| 3646 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |   |
| 3647 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |        |   |                                                |   |       |   |   |   |   |   |
| 3648 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |        |   |                                                |   |       |   |   |   |   |   |
| 3649 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |   |
| 3650 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |        |   |                                                |   |       |   |   |   |   |   |
| 3651 | 95% CLT UCL                                                                                                                              |   | 9.509  |   | 95% Jackknife UCL                              |   | 9.756 |   |   |   |   |   |
| 3652 | 95% Standard Bootstrap UCL                                                                                                               |   | 9.37   |   | 95% Bootstrap-t UCL                            |   | 11.17 |   |   |   |   |   |
| 3653 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 9.798  |   | 95% Percentile Bootstrap UCL                   |   | 9.494 |   |   |   |   |   |
| 3654 | 95% BCA Bootstrap UCL                                                                                                                    |   | 10.12  |   |                                                |   |       |   |   |   |   |   |
| 3655 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 12.16  |   | 95% Chebyshev(Mean, Sd) UCL                    |   | 14.81 |   |   |   |   |   |
| 3656 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 18.5   |   | 99% Chebyshev(Mean, Sd) UCL                    |   | 25.74 |   |   |   |   |   |
| 3657 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |   |
| 3658 | <b>Suggested UCL to Use</b>                                                                                                              |   |        |   |                                                |   |       |   |   |   |   |   |
| 3659 | 95% Adjusted Gamma UCL                                                                                                                   |   | 13.78  |   |                                                |   |       |   |   |   |   |   |
| 3660 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |   |
| 3661 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |   |                                                |   |       |   |   |   |   |   |
| 3662 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |   |                                                |   |       |   |   |   |   |   |
| 3663 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |   |                                                |   |       |   |   |   |   |   |
| 3664 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |   |                                                |   |       |   |   |   |   |   |
| 3665 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |   |
| 3666 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |   |
| 3667 | <b>Result (eu3_chromium_overbank)</b>                                                                                                    |   |        |   |                                                |   |       |   |   |   |   |   |
| 3668 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |   |
| 3669 | <b>General Statistics</b>                                                                                                                |   |        |   |                                                |   |       |   |   |   |   |   |
| 3670 | Total Number of Observations                                                                                                             |   | 62     |   | Number of Distinct Observations                |   | 46    |   |   |   |   |   |
| 3671 |                                                                                                                                          |   |        |   | Number of Missing Observations                 |   | 0     |   |   |   |   |   |
| 3672 | Minimum                                                                                                                                  |   | 0.12   |   | Mean                                           |   | 4.431 |   |   |   |   |   |
| 3673 | Maximum                                                                                                                                  |   | 11.4   |   | Median                                         |   | 4     |   |   |   |   |   |
| 3674 | SD                                                                                                                                       |   | 2.061  |   | Std. Error of Mean                             |   | 0.262 |   |   |   |   |   |
| 3675 | Coefficient of Variation                                                                                                                 |   | 0.465  |   | Skewness                                       |   | 0.94  |   |   |   |   |   |
| 3676 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |   |
| 3677 | <b>Normal GOF Test</b>                                                                                                                   |   |        |   |                                                |   |       |   |   |   |   |   |
| 3678 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.949  |   | <b>Shapiro Wilk GOF Test</b>                   |   |       |   |   |   |   |   |
| 3679 | 5% Shapiro Wilk P Value                                                                                                                  |   | 0.0255 |   | Data Not Normal at 5% Significance Level       |   |       |   |   |   |   |   |
| 3680 | Lilliefors Test Statistic                                                                                                                |   | 0.116  |   | <b>Lilliefors GOF Test</b>                     |   |       |   |   |   |   |   |
| 3681 | 5% Lilliefors Critical Value                                                                                                             |   | 0.112  |   | Data Not Normal at 5% Significance Level       |   |       |   |   |   |   |   |
| 3682 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |        |   |                                                |   |       |   |   |   |   |   |
| 3683 |                                                                                                                                          |   |        |   |                                                |   |       |   |   |   |   |   |
| 3684 | <b>Assuming Normal Distribution</b>                                                                                                      |   |        |   |                                                |   |       |   |   |   |   |   |
| 3685 | 95% Normal UCL                                                                                                                           |   |        |   | 95% UCLs (Adjusted for Skewness)               |   |       |   |   |   |   |   |



|      | A                                                                                                                                        | B | C | D      | E | F                                                               | G | H | I | J | K     | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|---|-----------------------------------------------------------------|---|---|---|---|-------|---|
| 3753 | <b>Normal GOF Test</b>                                                                                                                   |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3754 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.926  |   | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |   |       |   |
| 3755 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.874  |   | Data appear Normal at 5% Significance Level                     |   |   |   |   |       |   |
| 3756 | Lilliefors Test Statistic                                                                                                                |   |   | 0.151  |   | <b>Lilliefors GOF Test</b>                                      |   |   |   |   |       |   |
| 3757 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.226  |   | Data appear Normal at 5% Significance Level                     |   |   |   |   |       |   |
| 3758 | <b>Data appear Normal at 5% Significance Level</b>                                                                                       |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3759 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3760 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3761 | <b>95% Normal UCL</b>                                                                                                                    |   |   |        |   | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |   |   |       |   |
| 3762 | 95% Student's-t UCL                                                                                                                      |   |   | 4.279  |   | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |   |   | 4.307 |   |
| 3763 |                                                                                                                                          |   |   |        |   | 95% Modified-t UCL (Johnson-1978)                               |   |   |   |   | 4.293 |   |
| 3764 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3765 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3766 | A-D Test Statistic                                                                                                                       |   |   | 0.385  |   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |   |   |       |   |
| 3767 | 5% A-D Critical Value                                                                                                                    |   |   | 0.741  |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |   |       |   |
| 3768 | K-S Test Statistic                                                                                                                       |   |   | 0.156  |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |   |   |       |   |
| 3769 | 5% K-S Critical Value                                                                                                                    |   |   | 0.23   |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |   |       |   |
| 3770 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3771 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3772 | <b>Gamma Statistics</b>                                                                                                                  |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3773 | k hat (MLE)                                                                                                                              |   |   | 3.742  |   | k star (bias corrected MLE)                                     |   |   |   |   | 2.988 |   |
| 3774 | Theta hat (MLE)                                                                                                                          |   |   | 0.916  |   | Theta star (bias corrected MLE)                                 |   |   |   |   | 1.147 |   |
| 3775 | nu hat (MLE)                                                                                                                             |   |   | 104.8  |   | nu star (bias corrected)                                        |   |   |   |   | 83.67 |   |
| 3776 | MLE Mean (bias corrected)                                                                                                                |   |   | 3.429  |   | MLE Sd (bias corrected)                                         |   |   |   |   | 1.983 |   |
| 3777 |                                                                                                                                          |   |   |        |   | Approximate Chi Square Value (0.05)                             |   |   |   |   | 63.58 |   |
| 3778 | Adjusted Level of Significance                                                                                                           |   |   | 0.0312 |   | Adjusted Chi Square Value                                       |   |   |   |   | 61.27 |   |
| 3779 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3780 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3781 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   |   | 4.511  |   | 95% Adjusted Gamma UCL (use when n<50)                          |   |   |   |   | 4.682 |   |
| 3782 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3783 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3784 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.932  |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |   |   |       |   |
| 3785 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.874  |   | Data appear Lognormal at 5% Significance Level                  |   |   |   |   |       |   |
| 3786 | Lilliefors Test Statistic                                                                                                                |   |   | 0.17   |   | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |   |   |       |   |
| 3787 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.226  |   | Data appear Lognormal at 5% Significance Level                  |   |   |   |   |       |   |
| 3788 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3789 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3790 | <b>Lognormal Statistics</b>                                                                                                              |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3791 | Minimum of Logged Data                                                                                                                   |   |   | 0.182  |   | Mean of logged Data                                             |   |   |   |   | 1.093 |   |
| 3792 | Maximum of Logged Data                                                                                                                   |   |   | 1.974  |   | SD of logged Data                                               |   |   |   |   | 0.568 |   |
| 3793 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3794 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3795 | 95% H-UCL                                                                                                                                |   |   | 4.896  |   | 90% Chebyshev (MVUE) UCL                                        |   |   |   |   | 5.09  |   |
| 3796 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 5.828  |   | 97.5% Chebyshev (MVUE) UCL                                      |   |   |   |   | 6.854 |   |
| 3797 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 8.868  |   |                                                                 |   |   |   |   |       |   |
| 3798 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3799 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3800 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3801 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3802 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3803 | 95% CLT UCL                                                                                                                              |   |   | 4.218  |   | 95% Jackknife UCL                                               |   |   |   |   | 4.279 |   |
| 3804 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 4.174  |   | 95% Bootstrap-t UCL                                             |   |   |   |   | 4.376 |   |
| 3805 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 4.43   |   | 95% Percentile Bootstrap UCL                                    |   |   |   |   | 4.193 |   |
| 3806 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 4.236  |   |                                                                 |   |   |   |   |       |   |
| 3807 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 4.869  |   | 95% Chebyshev(Mean, Sd) UCL                                     |   |   |   |   | 5.521 |   |
| 3808 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 6.427  |   | 99% Chebyshev(Mean, Sd) UCL                                     |   |   |   |   | 8.205 |   |
| 3809 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3810 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3811 | 95% Student's-t UCL                                                                                                                      |   |   | 4.279  |   |                                                                 |   |   |   |   |       |   |
| 3812 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3813 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3814 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3815 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3816 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3817 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3818 | <b>Result (eu3_cobalt_overbank)</b>                                                                                                      |   |   |        |   |                                                                 |   |   |   |   |       |   |
| 3819 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |   |

|      | A                                                                                                                         | B | C | D | E         | F | G                                                               | H | I | J | K      | L |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|---|-----------|---|-----------------------------------------------------------------|---|---|---|--------|---|
| 3820 | <b>General Statistics</b>                                                                                                 |   |   |   |           |   |                                                                 |   |   |   |        |   |
| 3821 | Total Number of Observations                                                                                              |   |   |   | 55        |   | Number of Distinct Observations                                 |   |   |   | 46     |   |
| 3822 | Number of Detects                                                                                                         |   |   |   | 53        |   | Number of Non-Detects                                           |   |   |   | 2      |   |
| 3823 | Number of Distinct Detects                                                                                                |   |   |   | 44        |   | Number of Distinct Non-Detects                                  |   |   |   | 2      |   |
| 3824 | Minimum Detect                                                                                                            |   |   |   | 0.65      |   | Minimum Non-Detect                                              |   |   |   | 0.037  |   |
| 3825 | Maximum Detect                                                                                                            |   |   |   | 39.5      |   | Maximum Non-Detect                                              |   |   |   | 0.039  |   |
| 3826 | Variance Detects                                                                                                          |   |   |   | 50.61     |   | Percent Non-Detects                                             |   |   |   | 3.6369 |   |
| 3827 | Mean Detects                                                                                                              |   |   |   | 7.415     |   | SD Detects                                                      |   |   |   | 7.114  |   |
| 3828 | Median Detects                                                                                                            |   |   |   | 4.9       |   | CV Detects                                                      |   |   |   | 0.959  |   |
| 3829 | Skewness Detects                                                                                                          |   |   |   | 2.528     |   | Kurtosis Detects                                                |   |   |   | 8.305  |   |
| 3830 | Mean of Logged Detects                                                                                                    |   |   |   | 1.647     |   | SD of Logged Detects                                            |   |   |   | 0.866  |   |
| 3831 |                                                                                                                           |   |   |   |           |   |                                                                 |   |   |   |        |   |
| 3832 | <b>Normal GOF Test on Detects Only</b>                                                                                    |   |   |   |           |   |                                                                 |   |   |   |        |   |
| 3833 | Shapiro Wilk Test Statistic                                                                                               |   |   |   | 0.756     |   | <b>Normal GOF Test on Detected Observations Only</b>            |   |   |   |        |   |
| 3834 | 5% Shapiro Wilk P Value                                                                                                   |   |   |   | 3.591E-11 |   | Detected Data Not Normal at 5% Significance Level               |   |   |   |        |   |
| 3835 | Lilliefors Test Statistic                                                                                                 |   |   |   | 0.172     |   | <b>Lilliefors GOF Test</b>                                      |   |   |   |        |   |
| 3836 | 5% Lilliefors Critical Value                                                                                              |   |   |   | 0.121     |   | Detected Data Not Normal at 5% Significance Level               |   |   |   |        |   |
| 3837 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                  |   |   |   |           |   |                                                                 |   |   |   |        |   |
| 3838 |                                                                                                                           |   |   |   |           |   |                                                                 |   |   |   |        |   |
| 3839 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |   |   |   |           |   |                                                                 |   |   |   |        |   |
| 3840 | KM Mean                                                                                                                   |   |   |   | 7.147     |   | KM Standard Error of Mean                                       |   |   |   | 0.96   |   |
| 3841 | KM SD                                                                                                                     |   |   |   | 7.054     |   | 95% KM (BCA) UCL                                                |   |   |   | 8.953  |   |
| 3842 | 95% KM (t) UCL                                                                                                            |   |   |   | 8.754     |   | 95% KM (Percentile Bootstrap) UCL                               |   |   |   | 8.758  |   |
| 3843 | 95% KM (z) UCL                                                                                                            |   |   |   | 8.726     |   | 95% KM Bootstrap t UCL                                          |   |   |   | 9.216  |   |
| 3844 | 90% KM Chebyshev UCL                                                                                                      |   |   |   | 10.03     |   | 95% KM Chebyshev UCL                                            |   |   |   | 11.33  |   |
| 3845 | 97.5% KM Chebyshev UCL                                                                                                    |   |   |   | 13.14     |   | 99% KM Chebyshev UCL                                            |   |   |   | 16.7   |   |
| 3846 |                                                                                                                           |   |   |   |           |   |                                                                 |   |   |   |        |   |
| 3847 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |   |           |   |                                                                 |   |   |   |        |   |
| 3848 | A-D Test Statistic                                                                                                        |   |   |   | 0.485     |   | <b>Anderson-Darling GOF Test</b>                                |   |   |   |        |   |
| 3849 | 5% A-D Critical Value                                                                                                     |   |   |   | 0.767     |   | detected data appear Gamma Distributed at 5% Significance Level |   |   |   |        |   |
| 3850 | K-S Test Statistic                                                                                                        |   |   |   | 0.097     |   | <b>Kolmogorov-Smirnov GOF</b>                                   |   |   |   |        |   |
| 3851 | 5% K-S Critical Value                                                                                                     |   |   |   | 0.124     |   | detected data appear Gamma Distributed at 5% Significance Level |   |   |   |        |   |
| 3852 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                    |   |   |   |           |   |                                                                 |   |   |   |        |   |
| 3853 |                                                                                                                           |   |   |   |           |   |                                                                 |   |   |   |        |   |
| 3854 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |   |           |   |                                                                 |   |   |   |        |   |
| 3855 | k hat (MLE)                                                                                                               |   |   |   | 1.548     |   | k star (bias corrected MLE)                                     |   |   |   | 1.473  |   |
| 3856 | Theta hat (MLE)                                                                                                           |   |   |   | 4.79      |   | Theta star (bias corrected MLE)                                 |   |   |   | 5.034  |   |
| 3857 | nu hat (MLE)                                                                                                              |   |   |   | 164.1     |   | nu star (bias corrected)                                        |   |   |   | 156.1  |   |
| 3858 | Mean (detects)                                                                                                            |   |   |   | 7.415     |   |                                                                 |   |   |   |        |   |
| 3859 |                                                                                                                           |   |   |   |           |   |                                                                 |   |   |   |        |   |
| 3860 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |   |           |   |                                                                 |   |   |   |        |   |
| 3861 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |   |           |   |                                                                 |   |   |   |        |   |
| 3862 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |   |           |   |                                                                 |   |   |   |        |   |
| 3863 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |   |           |   |                                                                 |   |   |   |        |   |
| 3864 | This is especially true when the sample size is small.                                                                    |   |   |   |           |   |                                                                 |   |   |   |        |   |
| 3865 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |   |           |   |                                                                 |   |   |   |        |   |
| 3866 | Minimum                                                                                                                   |   |   |   | 0.01      |   | Mean                                                            |   |   |   | 7.146  |   |
| 3867 | Maximum                                                                                                                   |   |   |   | 39.5      |   | Median                                                          |   |   |   | 4.9    |   |
| 3868 | SD                                                                                                                        |   |   |   | 7.12      |   | CV                                                              |   |   |   | 0.996  |   |
| 3869 | k hat (MLE)                                                                                                               |   |   |   | 1.05      |   | k star (bias corrected MLE)                                     |   |   |   | 1.004  |   |
| 3870 | Theta hat (MLE)                                                                                                           |   |   |   | 6.809     |   | Theta star (bias corrected MLE)                                 |   |   |   | 7.114  |   |
| 3871 | nu hat (MLE)                                                                                                              |   |   |   | 115.4     |   | nu star (bias corrected)                                        |   |   |   | 110.5  |   |
| 3872 | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   |   | 0.0456    |   |                                                                 |   |   |   |        |   |
| 3873 | Approximate Chi Square Value (110.48, $\alpha$ )                                                                          |   |   |   | 87.22     |   | Adjusted Chi Square Value (110.48, $\beta$ )                    |   |   |   | 86.67  |   |
| 3874 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   |   | 9.051     |   | 95% Gamma Adjusted UCL (use when $n < 50$ )                     |   |   |   | 9.109  |   |
| 3875 |                                                                                                                           |   |   |   |           |   |                                                                 |   |   |   |        |   |
| 3876 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |   |           |   |                                                                 |   |   |   |        |   |
| 3877 | Mean (KM)                                                                                                                 |   |   |   | 7.147     |   | SD (KM)                                                         |   |   |   | 7.054  |   |
| 3878 | Variance (KM)                                                                                                             |   |   |   | 49.75     |   | SE of Mean (KM)                                                 |   |   |   | 0.96   |   |
| 3879 | k hat (KM)                                                                                                                |   |   |   | 1.027     |   | k star (KM)                                                     |   |   |   | 0.983  |   |
| 3880 | nu hat (KM)                                                                                                               |   |   |   | 112.9     |   | nu star (KM)                                                    |   |   |   | 108.1  |   |
| 3881 | theta hat (KM)                                                                                                            |   |   |   | 6.962     |   | theta star (KM)                                                 |   |   |   | 7.273  |   |
| 3882 | 80% gamma percentile (KM)                                                                                                 |   |   |   | 11.52     |   | 90% gamma percentile (KM)                                       |   |   |   | 16.53  |   |
| 3883 | 95% gamma percentile (KM)                                                                                                 |   |   |   | 21.54     |   | 99% gamma percentile (KM)                                       |   |   |   | 33.2   |   |
| 3884 |                                                                                                                           |   |   |   |           |   |                                                                 |   |   |   |        |   |
| 3885 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |   |           |   |                                                                 |   |   |   |        |   |
| 3886 | Approximate Chi Square Value (108.10, $\alpha$ )                                                                          |   |   |   | 85.1      |   | Adjusted Chi Square Value (108.10, $\beta$ )                    |   |   |   | 84.55  |   |

| A    | B  | C                                                                                                                                        | D      | E                                                       | F     | G | H                                       | I | J | K | L |
|------|----|------------------------------------------------------------------------------------------------------------------------------------------|--------|---------------------------------------------------------|-------|---|-----------------------------------------|---|---|---|---|
| 3887 | 5% | Gamma Approximate KM-UCL (use when n>=50)                                                                                                | 9.078  | 95% Gamma Adjusted KM-UCL (use when n<50)               | 9.137 |   |                                         |   |   |   |   |
| 3888 |    |                                                                                                                                          |        |                                                         |       |   |                                         |   |   |   |   |
| 3889 |    | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |        |                                                         |       |   |                                         |   |   |   |   |
| 3890 |    | Shapiro Wilk Approximate Test Statistic                                                                                                  | 0.989  | <b>Shapiro Wilk GOF Test</b>                            |       |   |                                         |   |   |   |   |
| 3891 |    | 5% Shapiro Wilk P Value                                                                                                                  | 0.966  | Detected Data appear Lognormal at 5% Significance Level |       |   |                                         |   |   |   |   |
| 3892 |    | Lilliefors Test Statistic                                                                                                                | 0.0563 | <b>Lilliefors GOF Test</b>                              |       |   |                                         |   |   |   |   |
| 3893 |    | 5% Lilliefors Critical Value                                                                                                             | 0.121  | Detected Data appear Lognormal at 5% Significance Level |       |   |                                         |   |   |   |   |
| 3894 |    | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                           |        |                                                         |       |   |                                         |   |   |   |   |
| 3895 |    |                                                                                                                                          |        |                                                         |       |   |                                         |   |   |   |   |
| 3896 |    | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |        |                                                         |       |   |                                         |   |   |   |   |
| 3897 |    | Mean in Original Scale                                                                                                                   | 7.168  | Mean in Log Scale                                       | 1.57  |   |                                         |   |   |   |   |
| 3898 |    | SD in Original Scale                                                                                                                     | 7.098  | SD in Log Scale                                         | 0.939 |   |                                         |   |   |   |   |
| 3899 |    | 95% t UCL (assumes normality of ROS data)                                                                                                | 8.77   | 95% Percentile Bootstrap UCL                            | 8.799 |   |                                         |   |   |   |   |
| 3900 |    | 95% BCA Bootstrap UCL                                                                                                                    | 8.969  | 95% Bootstrap t UCL                                     | 9.244 |   |                                         |   |   |   |   |
| 3901 |    | 95% H-UCL (Log ROS)                                                                                                                      | 9.966  |                                                         |       |   |                                         |   |   |   |   |
| 3902 |    |                                                                                                                                          |        |                                                         |       |   |                                         |   |   |   |   |
| 3903 |    | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |        |                                                         |       |   |                                         |   |   |   |   |
| 3904 |    | KM Mean (logged)                                                                                                                         | 1.467  | KM Geo Mean                                             | 4.337 |   |                                         |   |   |   |   |
| 3905 |    | KM SD (logged)                                                                                                                           | 1.251  | 95% Critical H Value (KM-Log)                           | 2.703 |   |                                         |   |   |   |   |
| 3906 |    | KM Standard Error of Mean (logged)                                                                                                       | 0.17   | 95% H-UCL (KM -Log)                                     | 15.03 |   |                                         |   |   |   |   |
| 3907 |    | KM SD (logged)                                                                                                                           | 1.251  | 95% Critical H Value (KM-Log)                           | 2.703 |   |                                         |   |   |   |   |
| 3908 |    | KM Standard Error of Mean (logged)                                                                                                       | 0.17   |                                                         |       |   |                                         |   |   |   |   |
| 3909 |    |                                                                                                                                          |        |                                                         |       |   |                                         |   |   |   |   |
| 3910 |    | <b>DL/2 Statistics</b>                                                                                                                   |        |                                                         |       |   |                                         |   |   |   |   |
| 3911 |    | <b>DL/2 Normal</b>                                                                                                                       |        |                                                         |       |   | <b>DL/2 Log-Transformed</b>             |   |   |   |   |
| 3912 |    | Mean in Original Scale                                                                                                                   | 7.146  | Mean in Log Scale                                       | 1.443 |   |                                         |   |   |   |   |
| 3913 |    | SD in Original Scale                                                                                                                     | 7.119  | SD in Log Scale                                         | 1.358 |   |                                         |   |   |   |   |
| 3914 |    | 95% t UCL (Assumes normality)                                                                                                            | 8.753  | 95% H-Stat UCL                                          | 18.02 |   |                                         |   |   |   |   |
| 3915 |    | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |        |                                                         |       |   |                                         |   |   |   |   |
| 3916 |    |                                                                                                                                          |        |                                                         |       |   |                                         |   |   |   |   |
| 3917 |    | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |                                                         |       |   |                                         |   |   |   |   |
| 3918 |    | <b>Detected Data appear Gamma Distributed at 5% Significance Level</b>                                                                   |        |                                                         |       |   |                                         |   |   |   |   |
| 3919 |    |                                                                                                                                          |        |                                                         |       |   |                                         |   |   |   |   |
| 3920 |    | <b>Suggested UCL to Use</b>                                                                                                              |        |                                                         |       |   |                                         |   |   |   |   |
| 3921 |    | 95% KM Approximate Gamma UCL                                                                                                             | 9.078  | 95% GROS Approximate Gamma UCL                          | 9.051 |   |                                         |   |   |   |   |
| 3922 |    |                                                                                                                                          |        |                                                         |       |   |                                         |   |   |   |   |
| 3923 |    | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |                                                         |       |   |                                         |   |   |   |   |
| 3924 |    | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |                                                         |       |   |                                         |   |   |   |   |
| 3925 |    | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |                                                         |       |   |                                         |   |   |   |   |
| 3926 |    | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |                                                         |       |   |                                         |   |   |   |   |
| 3927 |    |                                                                                                                                          |        |                                                         |       |   |                                         |   |   |   |   |
| 3928 |    |                                                                                                                                          |        |                                                         |       |   |                                         |   |   |   |   |
| 3929 |    | <b>Result (eu3_cobalt_waste rock)</b>                                                                                                    |        |                                                         |       |   |                                         |   |   |   |   |
| 3930 |    |                                                                                                                                          |        |                                                         |       |   |                                         |   |   |   |   |
| 3931 |    | <b>General Statistics</b>                                                                                                                |        |                                                         |       |   |                                         |   |   |   |   |
| 3932 |    | Total Number of Observations                                                                                                             | 14     | Number of Distinct Observations                         | 14    |   |                                         |   |   |   |   |
| 3933 |    |                                                                                                                                          |        | Number of Missing Observations                          | 0     |   |                                         |   |   |   |   |
| 3934 |    | Minimum                                                                                                                                  | 0.32   | Mean                                                    | 4.465 |   |                                         |   |   |   |   |
| 3935 |    | Maximum                                                                                                                                  | 35.5   | Median                                                  | 1.35  |   |                                         |   |   |   |   |
| 3936 |    | SD                                                                                                                                       | 9.124  | Std. Error of Mean                                      | 2.439 |   |                                         |   |   |   |   |
| 3937 |    | Coefficient of Variation                                                                                                                 | 2.044  | Skewness                                                | 3.484 |   |                                         |   |   |   |   |
| 3938 |    |                                                                                                                                          |        |                                                         |       |   |                                         |   |   |   |   |
| 3939 |    | <b>Normal GOF Test</b>                                                                                                                   |        |                                                         |       |   |                                         |   |   |   |   |
| 3940 |    | Shapiro Wilk Test Statistic                                                                                                              | 0.465  | <b>Shapiro Wilk GOF Test</b>                            |       |   |                                         |   |   |   |   |
| 3941 |    | 5% Shapiro Wilk Critical Value                                                                                                           | 0.874  | Data Not Normal at 5% Significance Level                |       |   |                                         |   |   |   |   |
| 3942 |    | Lilliefors Test Statistic                                                                                                                | 0.36   | <b>Lilliefors GOF Test</b>                              |       |   |                                         |   |   |   |   |
| 3943 |    | 5% Lilliefors Critical Value                                                                                                             | 0.226  | Data Not Normal at 5% Significance Level                |       |   |                                         |   |   |   |   |
| 3944 |    | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |        |                                                         |       |   |                                         |   |   |   |   |
| 3945 |    |                                                                                                                                          |        |                                                         |       |   |                                         |   |   |   |   |
| 3946 |    | <b>Assuming Normal Distribution</b>                                                                                                      |        |                                                         |       |   |                                         |   |   |   |   |
| 3947 |    | <b>95% Normal UCL</b>                                                                                                                    |        |                                                         |       |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |   |   |   |
| 3948 |    | 95% Student's-t UCL                                                                                                                      | 8.784  | 95% Adjusted-CLT UCL (Chen-1995)                        | 10.9  |   |                                         |   |   |   |   |
| 3949 |    |                                                                                                                                          |        | 95% Modified-t UCL (Johnson-1978)                       | 9.162 |   |                                         |   |   |   |   |
| 3950 |    |                                                                                                                                          |        |                                                         |       |   |                                         |   |   |   |   |
| 3951 |    | <b>Gamma GOF Test</b>                                                                                                                    |        |                                                         |       |   |                                         |   |   |   |   |
| 3952 |    | A-D Test Statistic                                                                                                                       | 1.059  | <b>Anderson-Darling Gamma GOF Test</b>                  |       |   |                                         |   |   |   |   |
| 3953 |    | 5% A-D Critical Value                                                                                                                    | 0.779  | Data Not Gamma Distributed at 5% Significance Level     |       |   |                                         |   |   |   |   |

| A    | B                                                                                                                                        | C | D | E      | F                                                               | G | H | I     | J | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------------------|---|---|-------|---|---|---|--|
| 3954 | K-S Test Statistic                                                                                                                       |   |   | 0.2    | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |       |   |   |   |  |
| 3955 | 5% K-S Critical Value                                                                                                                    |   |   | 0.239  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |  |
| 3956 | <b>Detected data follow Appr. Gamma Distribution at 5% Significance Level</b>                                                            |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 3957 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 3958 | <b>Gamma Statistics</b>                                                                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 3959 | k hat (MLE)                                                                                                                              |   |   | 0.657  | k star (bias corrected MLE)                                     |   |   | 0.564 |   |   |   |  |
| 3960 | Theta hat (MLE)                                                                                                                          |   |   | 6.799  | Theta star (bias corrected MLE)                                 |   |   | 7.922 |   |   |   |  |
| 3961 | nu hat (MLE)                                                                                                                             |   |   | 18.39  | nu star (bias corrected)                                        |   |   | 15.78 |   |   |   |  |
| 3962 | MLE Mean (bias corrected)                                                                                                                |   |   | 4.465  | MLE Sd (bias corrected)                                         |   |   | 5.948 |   |   |   |  |
| 3963 |                                                                                                                                          |   |   |        | Approximate Chi Square Value (0.05)                             |   |   | 7.808 |   |   |   |  |
| 3964 | Adjusted Level of Significance                                                                                                           |   |   | 0.0312 | Adjusted Chi Square Value                                       |   |   | 7.075 |   |   |   |  |
| 3965 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 3966 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 3967 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   |   | 9.025  | 95% Adjusted Gamma UCL (use when n<50)                          |   |   | 9.959 |   |   |   |  |
| 3968 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 3969 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 3970 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.943  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |       |   |   |   |  |
| 3971 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.874  | Data appear Lognormal at 5% Significance Level                  |   |   |       |   |   |   |  |
| 3972 | Lilliefors Test Statistic                                                                                                                |   |   | 0.123  | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |       |   |   |   |  |
| 3973 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.226  | Data appear Lognormal at 5% Significance Level                  |   |   |       |   |   |   |  |
| 3974 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 3975 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 3976 | <b>Lognormal Statistics</b>                                                                                                              |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 3977 | Minimum of Logged Data                                                                                                                   |   |   | -1.139 | Mean of logged Data                                             |   |   | 0.568 |   |   |   |  |
| 3978 | Maximum of Logged Data                                                                                                                   |   |   | 3.57   | SD of logged Data                                               |   |   | 1.249 |   |   |   |  |
| 3979 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 3980 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 3981 | 95% H-UCL                                                                                                                                |   |   | 11.75  | 90% Chebyshev (MVUE) UCL                                        |   |   | 7.446 |   |   |   |  |
| 3982 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 9.221  | 97.5% Chebyshev (MVUE) UCL                                      |   |   | 11.69 |   |   |   |  |
| 3983 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 16.53  |                                                                 |   |   |       |   |   |   |  |
| 3984 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 3985 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 3986 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 3987 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 3988 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 3989 | 95% CLT UCL                                                                                                                              |   |   | 8.476  | 95% Jackknife UCL                                               |   |   | 8.784 |   |   |   |  |
| 3990 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 8.508  | 95% Bootstrap-t UCL                                             |   |   | 24.6  |   |   |   |  |
| 3991 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 23.12  | 95% Percentile Bootstrap UCL                                    |   |   | 8.941 |   |   |   |  |
| 3992 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 11.69  |                                                                 |   |   |       |   |   |   |  |
| 3993 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 11.78  | 95% Chebyshev(Mean, Sd) UCL                                     |   |   | 15.09 |   |   |   |  |
| 3994 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 19.69  | 99% Chebyshev(Mean, Sd) UCL                                     |   |   | 28.73 |   |   |   |  |
| 3995 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 3996 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 3997 | 95% Adjusted Gamma UCL                                                                                                                   |   |   | 9.959  |                                                                 |   |   |       |   |   |   |  |
| 3998 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 3999 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                           |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 4000 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                   |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 4001 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 4002 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 4003 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 4004 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 4005 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 4006 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 4007 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 4008 | <b>Result (eu3_iron_overbank)</b>                                                                                                        |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 4009 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 4010 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 4011 | Total Number of Observations                                                                                                             |   |   | 62     | Number of Distinct Observations                                 |   |   | 59    |   |   |   |  |
| 4012 |                                                                                                                                          |   |   |        | Number of Missing Observations                                  |   |   | 0     |   |   |   |  |
| 4013 | Minimum                                                                                                                                  |   |   | 19900  | Mean                                                            |   |   | 47071 |   |   |   |  |
| 4014 | Maximum                                                                                                                                  |   |   | 292000 | Median                                                          |   |   | 40000 |   |   |   |  |
| 4015 | SD                                                                                                                                       |   |   | 35611  | Std. Error of Mean                                              |   |   | 4523  |   |   |   |  |
| 4016 | Coefficient of Variation                                                                                                                 |   |   | 0.757  | Skewness                                                        |   |   | 5.541 |   |   |   |  |
| 4017 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 4018 | <b>Normal GOF Test</b>                                                                                                                   |   |   |        |                                                                 |   |   |       |   |   |   |  |
| 4019 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.52   | <b>Shapiro Wilk GOF Test</b>                                    |   |   |       |   |   |   |  |
| 4020 | 5% Shapiro Wilk P Value                                                                                                                  |   |   | 0      | Data Not Normal at 5% Significance Level                        |   |   |       |   |   |   |  |

| A    | B                                                                                                                                        | C | D | E         | F                                                   | G | H | I | J | K     | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|-----------|-----------------------------------------------------|---|---|---|---|-------|---|
| 4021 | Lilliefors Test Statistic                                                                                                                |   |   | 0.229     | <b>Lilliefors GOF Test</b>                          |   |   |   |   |       |   |
| 4022 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.112     | Data Not Normal at 5% Significance Level            |   |   |   |   |       |   |
| 4023 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |           |                                                     |   |   |   |   |       |   |
| 4024 |                                                                                                                                          |   |   |           |                                                     |   |   |   |   |       |   |
| 4025 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |           |                                                     |   |   |   |   |       |   |
| 4026 | <b>95% Normal UCL</b>                                                                                                                    |   |   |           | <b>95% UCLs (Adjusted for Skewness)</b>             |   |   |   |   |       |   |
| 4027 | 95% Student's-t UCL                                                                                                                      |   |   | 54625     | 95% Adjusted-CLT UCL (Chen-1995)                    |   |   |   |   | 57911 |   |
| 4028 |                                                                                                                                          |   |   |           | 95% Modified-t UCL (Johnson-1978)                   |   |   |   |   | 55155 |   |
| 4029 |                                                                                                                                          |   |   |           |                                                     |   |   |   |   |       |   |
| 4030 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |           |                                                     |   |   |   |   |       |   |
| 4031 | A-D Test Statistic                                                                                                                       |   |   | 1.925     | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |   |   |       |   |
| 4032 | 5% A-D Critical Value                                                                                                                    |   |   | 0.754     | Data Not Gamma Distributed at 5% Significance Level |   |   |   |   |       |   |
| 4033 | K-S Test Statistic                                                                                                                       |   |   | 0.118     | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |   |   |       |   |
| 4034 | 5% K-S Critical Value                                                                                                                    |   |   | 0.113     | Data Not Gamma Distributed at 5% Significance Level |   |   |   |   |       |   |
| 4035 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |   |           |                                                     |   |   |   |   |       |   |
| 4036 |                                                                                                                                          |   |   |           |                                                     |   |   |   |   |       |   |
| 4037 | <b>Gamma Statistics</b>                                                                                                                  |   |   |           |                                                     |   |   |   |   |       |   |
| 4038 | k hat (MLE)                                                                                                                              |   |   | 4.197     | k star (bias corrected MLE)                         |   |   |   |   | 4.005 |   |
| 4039 | Theta hat (MLE)                                                                                                                          |   |   | 11214     | Theta star (bias corrected MLE)                     |   |   |   |   | 11753 |   |
| 4040 | nu hat (MLE)                                                                                                                             |   |   | 520.5     | nu star (bias corrected)                            |   |   |   |   | 496.6 |   |
| 4041 | MLE Mean (bias corrected)                                                                                                                |   |   | 47071     | MLE Sd (bias corrected)                             |   |   |   |   | 23521 |   |
| 4042 |                                                                                                                                          |   |   |           | Approximate Chi Square Value (0.05)                 |   |   |   |   | 445.9 |   |
| 4043 | Adjusted Level of Significance                                                                                                           |   |   | 0.0461    | Adjusted Chi Square Value                           |   |   |   |   | 444.8 |   |
| 4044 |                                                                                                                                          |   |   |           |                                                     |   |   |   |   |       |   |
| 4045 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |           |                                                     |   |   |   |   |       |   |
| 4046 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |   | 52420     | 95% Adjusted Gamma UCL (use when n<50)              |   |   |   |   | 52554 |   |
| 4047 |                                                                                                                                          |   |   |           |                                                     |   |   |   |   |       |   |
| 4048 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |           |                                                     |   |   |   |   |       |   |
| 4049 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.918     | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |   |   |   |       |   |
| 4050 | 5% Shapiro Wilk P Value                                                                                                                  |   |   | 3.2609E-4 | Data Not Lognormal at 5% Significance Level         |   |   |   |   |       |   |
| 4051 | Lilliefors Test Statistic                                                                                                                |   |   | 0.075     | <b>Lilliefors Lognormal GOF Test</b>                |   |   |   |   |       |   |
| 4052 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.112     | Data appear Lognormal at 5% Significance Level      |   |   |   |   |       |   |
| 4053 | <b>Data appear Approximate Lognormal at 5% Significance Level</b>                                                                        |   |   |           |                                                     |   |   |   |   |       |   |
| 4054 |                                                                                                                                          |   |   |           |                                                     |   |   |   |   |       |   |
| 4055 | <b>Lognormal Statistics</b>                                                                                                              |   |   |           |                                                     |   |   |   |   |       |   |
| 4056 | Minimum of Logged Data                                                                                                                   |   |   | 9.898     | Mean of logged Data                                 |   |   |   |   | 10.64 |   |
| 4057 | Maximum of Logged Data                                                                                                                   |   |   | 12.58     | SD of logged Data                                   |   |   |   |   | 0.44  |   |
| 4058 |                                                                                                                                          |   |   |           |                                                     |   |   |   |   |       |   |
| 4059 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |           |                                                     |   |   |   |   |       |   |
| 4060 | 95% H-UCL                                                                                                                                |   |   | 50770     | 90% Chebyshev (MVUE) UCL                            |   |   |   |   | 53709 |   |
| 4061 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 57321     | 97.5% Chebyshev (MVUE) UCL                          |   |   |   |   | 62336 |   |
| 4062 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 72185     |                                                     |   |   |   |   |       |   |
| 4063 |                                                                                                                                          |   |   |           |                                                     |   |   |   |   |       |   |
| 4064 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |           |                                                     |   |   |   |   |       |   |
| 4065 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |           |                                                     |   |   |   |   |       |   |
| 4066 |                                                                                                                                          |   |   |           |                                                     |   |   |   |   |       |   |
| 4067 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |           |                                                     |   |   |   |   |       |   |
| 4068 | 95% CLT UCL                                                                                                                              |   |   | 54510     | 95% Jackknife UCL                                   |   |   |   |   | 54625 |   |
| 4069 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 54398     | 95% Bootstrap-t UCL                                 |   |   |   |   | 62144 |   |
| 4070 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 86074     | 95% Percentile Bootstrap UCL                        |   |   |   |   | 55173 |   |
| 4071 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 59266     |                                                     |   |   |   |   |       |   |
| 4072 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 60639     | 95% Chebyshev(Mean, Sd) UCL                         |   |   |   |   | 66784 |   |
| 4073 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 75314     | 99% Chebyshev(Mean, Sd) UCL                         |   |   |   |   | 92070 |   |
| 4074 |                                                                                                                                          |   |   |           |                                                     |   |   |   |   |       |   |
| 4075 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |           |                                                     |   |   |   |   |       |   |
| 4076 | 95% Student's-t UCL                                                                                                                      |   |   | 54625     | or 95% Modified-t UCL                               |   |   |   |   | 55155 |   |
| 4077 | or 95% H-UCL                                                                                                                             |   |   | 50770     |                                                     |   |   |   |   |       |   |
| 4078 |                                                                                                                                          |   |   |           |                                                     |   |   |   |   |       |   |
| 4079 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |           |                                                     |   |   |   |   |       |   |
| 4080 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |           |                                                     |   |   |   |   |       |   |
| 4081 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |           |                                                     |   |   |   |   |       |   |
| 4082 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |           |                                                     |   |   |   |   |       |   |
| 4083 |                                                                                                                                          |   |   |           |                                                     |   |   |   |   |       |   |
| 4084 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |   |   |           |                                                     |   |   |   |   |       |   |
| 4085 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |   |   |           |                                                     |   |   |   |   |       |   |
| 4086 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |   |   |           |                                                     |   |   |   |   |       |   |
| 4087 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |   |   |           |                                                     |   |   |   |   |       |   |

|      | A                                                                                | B | C | D      | E | F | G                                                   | H | I | J      | K | L |
|------|----------------------------------------------------------------------------------|---|---|--------|---|---|-----------------------------------------------------|---|---|--------|---|---|
| 4088 |                                                                                  |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4089 |                                                                                  |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4090 | <b>Result (eu3_iron_waste rock)</b>                                              |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4091 |                                                                                  |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4092 | <b>General Statistics</b>                                                        |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4093 | Total Number of Observations                                                     |   |   | 14     |   |   | Number of Distinct Observations                     |   |   | 14     |   |   |
| 4094 |                                                                                  |   |   |        |   |   | Number of Missing Observations                      |   |   | 0      |   |   |
| 4095 | Minimum                                                                          |   |   | 24000  |   |   | Mean                                                |   |   | 59014  |   |   |
| 4096 | Maximum                                                                          |   |   | 257000 |   |   | Median                                              |   |   | 37050  |   |   |
| 4097 | SD                                                                               |   |   | 59998  |   |   | Std. Error of Mean                                  |   |   | 16035  |   |   |
| 4098 | Coefficient of Variation                                                         |   |   | 1.017  |   |   | Skewness                                            |   |   | 3.154  |   |   |
| 4099 |                                                                                  |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4100 | <b>Normal GOF Test</b>                                                           |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4101 | Shapiro Wilk Test Statistic                                                      |   |   | 0.566  |   |   | <b>Shapiro Wilk GOF Test</b>                        |   |   |        |   |   |
| 4102 | 5% Shapiro Wilk Critical Value                                                   |   |   | 0.874  |   |   | Data Not Normal at 5% Significance Level            |   |   |        |   |   |
| 4103 | Lilliefors Test Statistic                                                        |   |   | 0.286  |   |   | <b>Lilliefors GOF Test</b>                          |   |   |        |   |   |
| 4104 | 5% Lilliefors Critical Value                                                     |   |   | 0.226  |   |   | Data Not Normal at 5% Significance Level            |   |   |        |   |   |
| 4105 | <b>Data Not Normal at 5% Significance Level</b>                                  |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4106 |                                                                                  |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4107 | <b>Assuming Normal Distribution</b>                                              |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4108 | <b>95% Normal UCL</b>                                                            |   |   |        |   |   | <b>95% UCLs (Adjusted for Skewness)</b>             |   |   |        |   |   |
| 4109 | 95% Student's-t UCL                                                              |   |   | 87411  |   |   | 95% Adjusted-CLT UCL (Chen-1995)                    |   |   | 99832  |   |   |
| 4110 |                                                                                  |   |   |        |   |   | 95% Modified-t UCL (Johnson-1978)                   |   |   | 89664  |   |   |
| 4111 |                                                                                  |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4112 | <b>Gamma GOF Test</b>                                                            |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4113 | A-D Test Statistic                                                               |   |   | 1.188  |   |   | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |        |   |   |
| 4114 | 5% A-D Critical Value                                                            |   |   | 0.745  |   |   | Data Not Gamma Distributed at 5% Significance Level |   |   |        |   |   |
| 4115 | K-S Test Statistic                                                               |   |   | 0.252  |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |        |   |   |
| 4116 | 5% K-S Critical Value                                                            |   |   | 0.231  |   |   | Data Not Gamma Distributed at 5% Significance Level |   |   |        |   |   |
| 4117 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                       |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4118 |                                                                                  |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4119 | <b>Gamma Statistics</b>                                                          |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4120 | k hat (MLE)                                                                      |   |   | 2.165  |   |   | k star (bias corrected MLE)                         |   |   | 1.749  |   |   |
| 4121 | Theta hat (MLE)                                                                  |   |   | 27253  |   |   | Theta star (bias corrected MLE)                     |   |   | 33741  |   |   |
| 4122 | nu hat (MLE)                                                                     |   |   | 60.63  |   |   | nu star (bias corrected)                            |   |   | 48.97  |   |   |
| 4123 | MLE Mean (bias corrected)                                                        |   |   | 59014  |   |   | MLE Sd (bias corrected)                             |   |   | 44623  |   |   |
| 4124 |                                                                                  |   |   |        |   |   | Approximate Chi Square Value (0.05)                 |   |   | 33.91  |   |   |
| 4125 | Adjusted Level of Significance                                                   |   |   | 0.0312 |   |   | Adjusted Chi Square Value                           |   |   | 32.25  |   |   |
| 4126 |                                                                                  |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4127 | <b>Assuming Gamma Distribution</b>                                               |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4128 | 95% Approximate Gamma UCL (use when n>=50))                                      |   |   | 85234  |   |   | 95% Adjusted Gamma UCL (use when n<50)              |   |   | 89615  |   |   |
| 4129 |                                                                                  |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4130 | <b>Lognormal GOF Test</b>                                                        |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4131 | Shapiro Wilk Test Statistic                                                      |   |   | 0.848  |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |   |        |   |   |
| 4132 | 5% Shapiro Wilk Critical Value                                                   |   |   | 0.874  |   |   | Data Not Lognormal at 5% Significance Level         |   |   |        |   |   |
| 4133 | Lilliefors Test Statistic                                                        |   |   | 0.218  |   |   | <b>Lilliefors Lognormal GOF Test</b>                |   |   |        |   |   |
| 4134 | 5% Lilliefors Critical Value                                                     |   |   | 0.226  |   |   | Data appear Lognormal at 5% Significance Level      |   |   |        |   |   |
| 4135 | <b>Data appear Approximate Lognormal at 5% Significance Level</b>                |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4136 |                                                                                  |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4137 | <b>Lognormal Statistics</b>                                                      |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4138 | Minimum of Logged Data                                                           |   |   | 10.09  |   |   | Mean of logged Data                                 |   |   | 10.74  |   |   |
| 4139 | Maximum of Logged Data                                                           |   |   | 12.46  |   |   | SD of logged Data                                   |   |   | 0.633  |   |   |
| 4140 |                                                                                  |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4141 | <b>Assuming Lognormal Distribution</b>                                           |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4142 | 95% H-UCL                                                                        |   |   | 83648  |   |   | 90% Chebyshev (MVUE) UCL                            |   |   | 84645  |   |   |
| 4143 | 95% Chebyshev (MVUE) UCL                                                         |   |   | 97919  |   |   | 97.5% Chebyshev (MVUE) UCL                          |   |   | 116343 |   |   |
| 4144 | 99% Chebyshev (MVUE) UCL                                                         |   |   | 152533 |   |   |                                                     |   |   |        |   |   |
| 4145 |                                                                                  |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4146 | <b>Nonparametric Distribution Free UCL Statistics</b>                            |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4147 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b> |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4148 |                                                                                  |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4149 | <b>Nonparametric Distribution Free UCLs</b>                                      |   |   |        |   |   |                                                     |   |   |        |   |   |
| 4150 | 95% CLT UCL                                                                      |   |   | 85390  |   |   | 95% Jackknife UCL                                   |   |   | 87411  |   |   |
| 4151 | 95% Standard Bootstrap UCL                                                       |   |   | 85124  |   |   | 95% Bootstrap-t UCL                                 |   |   | 143564 |   |   |
| 4152 | 95% Hall's Bootstrap UCL                                                         |   |   | 182678 |   |   | 95% Percentile Bootstrap UCL                        |   |   | 88357  |   |   |
| 4153 | 95% BCA Bootstrap UCL                                                            |   |   | 105871 |   |   |                                                     |   |   |        |   |   |
| 4154 | 90% Chebyshev(Mean, Sd) UCL                                                      |   |   | 107120 |   |   | 95% Chebyshev(Mean, Sd) UCL                         |   |   | 128910 |   |   |

| A    | B                                                                                                                                        | C | D | E                                       | F                                                   | G | H | I      | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|-----------------------------------------|-----------------------------------------------------|---|---|--------|---|---|---|
| 4155 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 159154                                  | 99% Chebyshev(Mean, Sd) UCL                         |   |   | 218562 |   |   |   |
| 4156 |                                                                                                                                          |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4157 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4158 | 95% H-UCL                                                                                                                                |   |   | 83648                                   |                                                     |   |   |        |   |   |   |
| 4159 |                                                                                                                                          |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4160 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4161 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4162 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4163 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4164 |                                                                                                                                          |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4165 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4166 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4167 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4168 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4169 |                                                                                                                                          |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4170 |                                                                                                                                          |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4171 | <b>Result (eu3_manganese_overbank)</b>                                                                                                   |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4172 |                                                                                                                                          |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4173 | <b>General Statistics</b>                                                                                                                |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4174 | Total Number of Observations                                                                                                             |   |   | 62                                      | Number of Distinct Observations                     |   |   | 60     |   |   |   |
| 4175 |                                                                                                                                          |   |   |                                         | Number of Missing Observations                      |   |   | 0      |   |   |   |
| 4176 | Minimum                                                                                                                                  |   |   | 9                                       | Mean                                                |   |   | 1992   |   |   |   |
| 4177 | Maximum                                                                                                                                  |   |   | 35900                                   | Median                                              |   |   | 623.5  |   |   |   |
| 4178 | SD                                                                                                                                       |   |   | 4933                                    | Std. Error of Mean                                  |   |   | 626.5  |   |   |   |
| 4179 | Coefficient of Variation                                                                                                                 |   |   | 2.476                                   | Skewness                                            |   |   | 5.847  |   |   |   |
| 4180 |                                                                                                                                          |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4181 | <b>Normal GOF Test</b>                                                                                                                   |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4182 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.379                                   | <b>Shapiro Wilk GOF Test</b>                        |   |   |        |   |   |   |
| 4183 | 5% Shapiro Wilk P Value                                                                                                                  |   |   | 0                                       | Data Not Normal at 5% Significance Level            |   |   |        |   |   |   |
| 4184 | Lilliefors Test Statistic                                                                                                                |   |   | 0.344                                   | <b>Lilliefors GOF Test</b>                          |   |   |        |   |   |   |
| 4185 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.112                                   | Data Not Normal at 5% Significance Level            |   |   |        |   |   |   |
| 4186 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4187 |                                                                                                                                          |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4188 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4189 | <b>95% Normal UCL</b>                                                                                                                    |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |                                                     |   |   |        |   |   |   |
| 4190 | 95% Student's-t UCL                                                                                                                      |   |   | 3039                                    | 95% Adjusted-CLT UCL (Chen-1995)                    |   |   | 3520   |   |   |   |
| 4191 |                                                                                                                                          |   |   |                                         | 95% Modified-t UCL (Johnson-1978)                   |   |   | 3116   |   |   |   |
| 4192 |                                                                                                                                          |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4193 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4194 | A-D Test Statistic                                                                                                                       |   |   | 2.588                                   | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |        |   |   |   |
| 4195 | 5% A-D Critical Value                                                                                                                    |   |   | 0.807                                   | Data Not Gamma Distributed at 5% Significance Level |   |   |        |   |   |   |
| 4196 | K-S Test Statistic                                                                                                                       |   |   | 0.167                                   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |        |   |   |   |
| 4197 | 5% K-S Critical Value                                                                                                                    |   |   | 0.119                                   | Data Not Gamma Distributed at 5% Significance Level |   |   |        |   |   |   |
| 4198 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4199 |                                                                                                                                          |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4200 | <b>Gamma Statistics</b>                                                                                                                  |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4201 | k hat (MLE)                                                                                                                              |   |   | 0.598                                   | k star (bias corrected MLE)                         |   |   | 0.58   |   |   |   |
| 4202 | Theta hat (MLE)                                                                                                                          |   |   | 3333                                    | Theta star (bias corrected MLE)                     |   |   | 3438   |   |   |   |
| 4203 | nu hat (MLE)                                                                                                                             |   |   | 74.12                                   | nu star (bias corrected)                            |   |   | 71.86  |   |   |   |
| 4204 | MLE Mean (bias corrected)                                                                                                                |   |   | 1992                                    | MLE Sd (bias corrected)                             |   |   | 2617   |   |   |   |
| 4205 |                                                                                                                                          |   |   |                                         | Approximate Chi Square Value (0.05)                 |   |   | 53.34  |   |   |   |
| 4206 | Adjusted Level of Significance                                                                                                           |   |   | 0.0461                                  | Adjusted Chi Square Value                           |   |   | 52.96  |   |   |   |
| 4207 |                                                                                                                                          |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4208 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4209 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   |   | 2684                                    | 95% Adjusted Gamma UCL (use when n<50)              |   |   | 2703   |   |   |   |
| 4210 |                                                                                                                                          |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4211 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4212 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.986                                   | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |   |        |   |   |   |
| 4213 | 5% Shapiro Wilk P Value                                                                                                                  |   |   | 0.877                                   | Data appear Lognormal at 5% Significance Level      |   |   |        |   |   |   |
| 4214 | Lilliefors Test Statistic                                                                                                                |   |   | 0.0587                                  | <b>Lilliefors Lognormal GOF Test</b>                |   |   |        |   |   |   |
| 4215 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.112                                   | Data appear Lognormal at 5% Significance Level      |   |   |        |   |   |   |
| 4216 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4217 |                                                                                                                                          |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4218 | <b>Lognormal Statistics</b>                                                                                                              |   |   |                                         |                                                     |   |   |        |   |   |   |
| 4219 | Minimum of Logged Data                                                                                                                   |   |   | 2.197                                   | Mean of logged Data                                 |   |   | 6.563  |   |   |   |
| 4220 | Maximum of Logged Data                                                                                                                   |   |   | 10.49                                   | SD of logged Data                                   |   |   | 1.39   |   |   |   |
| 4221 |                                                                                                                                          |   |   |                                         |                                                     |   |   |        |   |   |   |

| A    | B                                                                                                                                        | C | D | E      | F                                                   | G | H | I | J     | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------|---|---|---|-------|---|---|--|
| 4222 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4223 | 95% H-UCL                                                                                                                                |   |   | 2836   | 90% Chebyshev (MVUE) UCL                            |   |   |   | 3063  |   |   |  |
| 4224 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 3633   | 97.5% Chebyshev (MVUE) UCL                          |   |   |   | 4422  |   |   |  |
| 4225 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 5974   |                                                     |   |   |   |       |   |   |  |
| 4226 |                                                                                                                                          |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4227 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4228 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4229 |                                                                                                                                          |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4230 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4231 | 95% CLT UCL                                                                                                                              |   |   | 3023   | 95% Jackknife UCL                                   |   |   |   | 3039  |   |   |  |
| 4232 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 2996   | 95% Bootstrap-t UCL                                 |   |   |   | 5252  |   |   |  |
| 4233 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 7327   | 95% Percentile Bootstrap UCL                        |   |   |   | 3102  |   |   |  |
| 4234 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 3953   |                                                     |   |   |   |       |   |   |  |
| 4235 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 3872   | 95% Chebyshev(Mean, Sd) UCL                         |   |   |   | 4723  |   |   |  |
| 4236 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 5905   | 99% Chebyshev(Mean, Sd) UCL                         |   |   |   | 8226  |   |   |  |
| 4237 |                                                                                                                                          |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4238 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4239 | 95% H-UCL                                                                                                                                |   |   | 2836   |                                                     |   |   |   |       |   |   |  |
| 4240 |                                                                                                                                          |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4241 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4242 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4243 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4244 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4245 |                                                                                                                                          |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4246 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4247 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4248 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4249 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4250 |                                                                                                                                          |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4251 |                                                                                                                                          |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4252 | <b>Result (eu3_manganese_waste rock)</b>                                                                                                 |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4253 |                                                                                                                                          |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4254 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4255 | Total Number of Observations                                                                                                             |   |   | 14     | Number of Distinct Observations                     |   |   |   | 14    |   |   |  |
| 4256 |                                                                                                                                          |   |   |        | Number of Missing Observations                      |   |   |   | 0     |   |   |  |
| 4257 | Minimum                                                                                                                                  |   |   | 136    | Mean                                                |   |   |   | 789.7 |   |   |  |
| 4258 | Maximum                                                                                                                                  |   |   | 3780   | Median                                              |   |   |   | 592   |   |   |  |
| 4259 | SD                                                                                                                                       |   |   | 902.6  | Std. Error of Mean                                  |   |   |   | 241.2 |   |   |  |
| 4260 | Coefficient of Variation                                                                                                                 |   |   | 1.143  | Skewness                                            |   |   |   | 3.18  |   |   |  |
| 4261 |                                                                                                                                          |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4262 | <b>Normal GOF Test</b>                                                                                                                   |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4263 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.577  | <b>Shapiro Wilk GOF Test</b>                        |   |   |   |       |   |   |  |
| 4264 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.874  | Data Not Normal at 5% Significance Level            |   |   |   |       |   |   |  |
| 4265 | Lilliefors Test Statistic                                                                                                                |   |   | 0.32   | <b>Lilliefors GOF Test</b>                          |   |   |   |       |   |   |  |
| 4266 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.226  | Data Not Normal at 5% Significance Level            |   |   |   |       |   |   |  |
| 4267 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4268 |                                                                                                                                          |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4269 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4270 | <b>95% Normal UCL</b>                                                                                                                    |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>             |   |   |   |       |   |   |  |
| 4271 | 95% Student's-t UCL                                                                                                                      |   |   | 1217   | 95% Adjusted-CLT UCL (Chen-1995)                    |   |   |   | 1406  |   |   |  |
| 4272 |                                                                                                                                          |   |   |        | 95% Modified-t UCL (Johnson-1978)                   |   |   |   | 1251  |   |   |  |
| 4273 |                                                                                                                                          |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4274 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4275 | A-D Test Statistic                                                                                                                       |   |   | 0.853  | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |   |       |   |   |  |
| 4276 | 5% A-D Critical Value                                                                                                                    |   |   | 0.749  | Data Not Gamma Distributed at 5% Significance Level |   |   |   |       |   |   |  |
| 4277 | K-S Test Statistic                                                                                                                       |   |   | 0.233  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |   |       |   |   |  |
| 4278 | 5% K-S Critical Value                                                                                                                    |   |   | 0.232  | Data Not Gamma Distributed at 5% Significance Level |   |   |   |       |   |   |  |
| 4279 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4280 |                                                                                                                                          |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4281 | <b>Gamma Statistics</b>                                                                                                                  |   |   |        |                                                     |   |   |   |       |   |   |  |
| 4282 | k hat (MLE)                                                                                                                              |   |   | 1.655  | k star (bias corrected MLE)                         |   |   |   | 1.348 |   |   |  |
| 4283 | Theta hat (MLE)                                                                                                                          |   |   | 477.1  | Theta star (bias corrected MLE)                     |   |   |   | 585.7 |   |   |  |
| 4284 | nu hat (MLE)                                                                                                                             |   |   | 46.35  | nu star (bias corrected)                            |   |   |   | 37.75 |   |   |  |
| 4285 | MLE Mean (bias corrected)                                                                                                                |   |   | 789.7  | MLE Sd (bias corrected)                             |   |   |   | 680.1 |   |   |  |
| 4286 |                                                                                                                                          |   |   |        | Approximate Chi Square Value (0.05)                 |   |   |   | 24.68 |   |   |  |
| 4287 | Adjusted Level of Significance                                                                                                           |   |   | 0.0312 | Adjusted Chi Square Value                           |   |   |   | 23.29 |   |   |  |
| 4288 |                                                                                                                                          |   |   |        |                                                     |   |   |   |       |   |   |  |

| A    | B                                                                                                                                                 | C | D | E     | F                                              | G | H | I      | J | K | L |  |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------|---|---|-------|------------------------------------------------|---|---|--------|---|---|---|--|
| 4289 | <b>Assuming Gamma Distribution</b>                                                                                                                |   |   |       |                                                |   |   |        |   |   |   |  |
| 4290 | 95% Approximate Gamma UCL (use when n>=50))                                                                                                       |   |   | 1208  | 95% Adjusted Gamma UCL (use when n<50)         |   |   | 1280   |   |   |   |  |
| 4291 |                                                                                                                                                   |   |   |       |                                                |   |   |        |   |   |   |  |
| 4292 | <b>Lognormal GOF Test</b>                                                                                                                         |   |   |       |                                                |   |   |        |   |   |   |  |
| 4293 | Shapiro Wilk Test Statistic                                                                                                                       |   |   | 0.933 | <b>Shapiro Wilk Lognormal GOF Test</b>         |   |   |        |   |   |   |  |
| 4294 | 5% Shapiro Wilk Critical Value                                                                                                                    |   |   | 0.874 | Data appear Lognormal at 5% Significance Level |   |   |        |   |   |   |  |
| 4295 | Lilliefors Test Statistic                                                                                                                         |   |   | 0.17  | <b>Lilliefors Lognormal GOF Test</b>           |   |   |        |   |   |   |  |
| 4296 | 5% Lilliefors Critical Value                                                                                                                      |   |   | 0.226 | Data appear Lognormal at 5% Significance Level |   |   |        |   |   |   |  |
| 4297 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                             |   |   |       |                                                |   |   |        |   |   |   |  |
| 4298 |                                                                                                                                                   |   |   |       |                                                |   |   |        |   |   |   |  |
| 4299 | <b>Lognormal Statistics</b>                                                                                                                       |   |   |       |                                                |   |   |        |   |   |   |  |
| 4300 | Minimum of Logged Data                                                                                                                            |   |   | 4.913 | Mean of logged Data                            |   |   | 6.34   |   |   |   |  |
| 4301 | Maximum of Logged Data                                                                                                                            |   |   | 8.237 | SD of logged Data                              |   |   | 0.772  |   |   |   |  |
| 4302 |                                                                                                                                                   |   |   |       |                                                |   |   |        |   |   |   |  |
| 4303 | <b>Assuming Lognormal Distribution</b>                                                                                                            |   |   |       |                                                |   |   |        |   |   |   |  |
| 4304 | 95% H-UCL                                                                                                                                         |   |   | 1287  | 90% Chebyshev (MVUE) UCL                       |   |   | 1231   |   |   |   |  |
| 4305 | 95% Chebyshev (MVUE) UCL                                                                                                                          |   |   | 1452  | 97.5% Chebyshev (MVUE) UCL                     |   |   | 1758   |   |   |   |  |
| 4306 | 99% Chebyshev (MVUE) UCL                                                                                                                          |   |   | 2360  |                                                |   |   |        |   |   |   |  |
| 4307 |                                                                                                                                                   |   |   |       |                                                |   |   |        |   |   |   |  |
| 4308 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                             |   |   |       |                                                |   |   |        |   |   |   |  |
| 4309 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                                  |   |   |       |                                                |   |   |        |   |   |   |  |
| 4310 |                                                                                                                                                   |   |   |       |                                                |   |   |        |   |   |   |  |
| 4311 | <b>Nonparametric Distribution Free UCLs</b>                                                                                                       |   |   |       |                                                |   |   |        |   |   |   |  |
| 4312 | 95% CLT UCL                                                                                                                                       |   |   | 1187  | 95% Jackknife UCL                              |   |   | 1217   |   |   |   |  |
| 4313 | 95% Standard Bootstrap UCL                                                                                                                        |   |   | 1187  | 95% Bootstrap-t UCL                            |   |   | 1945   |   |   |   |  |
| 4314 | 95% Hall's Bootstrap UCL                                                                                                                          |   |   | 2798  | 95% Percentile Bootstrap UCL                   |   |   | 1239   |   |   |   |  |
| 4315 | 95% BCA Bootstrap UCL                                                                                                                             |   |   | 1465  |                                                |   |   |        |   |   |   |  |
| 4316 | 90% Chebyshev(Mean, Sd) UCL                                                                                                                       |   |   | 1513  | 95% Chebyshev(Mean, Sd) UCL                    |   |   | 1841   |   |   |   |  |
| 4317 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                                     |   |   | 2296  | 99% Chebyshev(Mean, Sd) UCL                    |   |   | 3190   |   |   |   |  |
| 4318 |                                                                                                                                                   |   |   |       |                                                |   |   |        |   |   |   |  |
| 4319 | <b>Suggested UCL to Use</b>                                                                                                                       |   |   |       |                                                |   |   |        |   |   |   |  |
| 4320 | 95% H-UCL                                                                                                                                         |   |   | 1287  |                                                |   |   |        |   |   |   |  |
| 4321 |                                                                                                                                                   |   |   |       |                                                |   |   |        |   |   |   |  |
| 4322 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.                      |   |   |       |                                                |   |   |        |   |   |   |  |
| 4323 | Recommendations are based upon data size, data distribution, and skewness.                                                                        |   |   |       |                                                |   |   |        |   |   |   |  |
| 4324 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                          |   |   |       |                                                |   |   |        |   |   |   |  |
| 4325 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.         |   |   |       |                                                |   |   |        |   |   |   |  |
| 4326 |                                                                                                                                                   |   |   |       |                                                |   |   |        |   |   |   |  |
| 4327 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                            |   |   |       |                                                |   |   |        |   |   |   |  |
| 4328 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>                     |   |   |       |                                                |   |   |        |   |   |   |  |
| 4329 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                                |   |   |       |                                                |   |   |        |   |   |   |  |
| 4330 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>                 |   |   |       |                                                |   |   |        |   |   |   |  |
| 4331 |                                                                                                                                                   |   |   |       |                                                |   |   |        |   |   |   |  |
| 4332 | <b>Result (eu3_thallium_overbank)</b>                                                                                                             |   |   |       |                                                |   |   |        |   |   |   |  |
| 4333 |                                                                                                                                                   |   |   |       |                                                |   |   |        |   |   |   |  |
| 4334 | <b>General Statistics</b>                                                                                                                         |   |   |       |                                                |   |   |        |   |   |   |  |
| 4335 | Total Number of Observations                                                                                                                      |   |   | 62    | Number of Distinct Observations                |   |   | 25     |   |   |   |  |
| 4336 | Number of Detects                                                                                                                                 |   |   | 1     | Number of Non-Detects                          |   |   | 61     |   |   |   |  |
| 4337 | Number of Distinct Detects                                                                                                                        |   |   | 1     | Number of Distinct Non-Detects                 |   |   | 24     |   |   |   |  |
| 4338 |                                                                                                                                                   |   |   |       |                                                |   |   |        |   |   |   |  |
| 4339 | <b>Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!</b>                  |   |   |       |                                                |   |   |        |   |   |   |  |
| 4340 | <b>It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, B)</b> |   |   |       |                                                |   |   |        |   |   |   |  |
| 4341 |                                                                                                                                                   |   |   |       |                                                |   |   |        |   |   |   |  |
| 4342 | <b>The data set for variable Result (eu3_thallium_overbank) was not processed!</b>                                                                |   |   |       |                                                |   |   |        |   |   |   |  |
| 4343 |                                                                                                                                                   |   |   |       |                                                |   |   |        |   |   |   |  |
| 4344 |                                                                                                                                                   |   |   |       |                                                |   |   |        |   |   |   |  |
| 4345 |                                                                                                                                                   |   |   |       |                                                |   |   |        |   |   |   |  |
| 4346 | <b>Result (eu3_thallium_waste rock)</b>                                                                                                           |   |   |       |                                                |   |   |        |   |   |   |  |
| 4347 |                                                                                                                                                   |   |   |       |                                                |   |   |        |   |   |   |  |
| 4348 | <b>General Statistics</b>                                                                                                                         |   |   |       |                                                |   |   |        |   |   |   |  |
| 4349 | Total Number of Observations                                                                                                                      |   |   | 14    | Number of Distinct Observations                |   |   | 13     |   |   |   |  |
| 4350 |                                                                                                                                                   |   |   |       | Number of Missing Observations                 |   |   | 0      |   |   |   |  |
| 4351 | Minimum                                                                                                                                           |   |   | 0.097 | Mean                                           |   |   | 0.355  |   |   |   |  |
| 4352 | Maximum                                                                                                                                           |   |   | 0.69  | Median                                         |   |   | 0.36   |   |   |   |  |
| 4353 | SD                                                                                                                                                |   |   | 0.14  | Std. Error of Mean                             |   |   | 0.0375 |   |   |   |  |
| 4354 | Coefficient of Variation                                                                                                                          |   |   | 0.395 | Skewness                                       |   |   | 0.581  |   |   |   |  |
| 4355 |                                                                                                                                                   |   |   |       |                                                |   |   |        |   |   |   |  |

| A    | B                                                                                                                                        | C | D      | E | F                                                               | G | H | I | J | K      | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|---|-----------------------------------------------------------------|---|---|---|---|--------|---|
| 4356 | <b>Normal GOF Test</b>                                                                                                                   |   |        |   |                                                                 |   |   |   |   |        |   |
| 4357 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.956  |   | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |   |        |   |
| 4358 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.874  |   | Data appear Normal at 5% Significance Level                     |   |   |   |   |        |   |
| 4359 | Lilliefors Test Statistic                                                                                                                |   | 0.155  |   | <b>Lilliefors GOF Test</b>                                      |   |   |   |   |        |   |
| 4360 | 5% Lilliefors Critical Value                                                                                                             |   | 0.226  |   | Data appear Normal at 5% Significance Level                     |   |   |   |   |        |   |
| 4361 | <b>Data appear Normal at 5% Significance Level</b>                                                                                       |   |        |   |                                                                 |   |   |   |   |        |   |
| 4362 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |   |        |   |
| 4363 | <b>Assuming Normal Distribution</b>                                                                                                      |   |        |   |                                                                 |   |   |   |   |        |   |
| 4364 | <b>95% Normal UCL</b>                                                                                                                    |   |        |   | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |   |   |        |   |
| 4365 | 95% Student's-t UCL                                                                                                                      |   | 0.421  |   | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |   |   | 0.423  |   |
| 4366 |                                                                                                                                          |   |        |   | 95% Modified-t UCL (Johnson-1978)                               |   |   |   |   | 0.422  |   |
| 4367 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |   |        |   |
| 4368 | <b>Gamma GOF Test</b>                                                                                                                    |   |        |   |                                                                 |   |   |   |   |        |   |
| 4369 | A-D Test Statistic                                                                                                                       |   | 0.341  |   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |   |   |        |   |
| 4370 | 5% A-D Critical Value                                                                                                                    |   | 0.737  |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |   |        |   |
| 4371 | K-S Test Statistic                                                                                                                       |   | 0.141  |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |   |   |        |   |
| 4372 | 5% K-S Critical Value                                                                                                                    |   | 0.229  |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |   |        |   |
| 4373 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |        |   |                                                                 |   |   |   |   |        |   |
| 4374 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |   |        |   |
| 4375 | <b>Gamma Statistics</b>                                                                                                                  |   |        |   |                                                                 |   |   |   |   |        |   |
| 4376 | k hat (MLE)                                                                                                                              |   | 6.021  |   | k star (bias corrected MLE)                                     |   |   |   |   | 4.779  |   |
| 4377 | Theta hat (MLE)                                                                                                                          |   | 0.0589 |   | Theta star (bias corrected MLE)                                 |   |   |   |   | 0.0742 |   |
| 4378 | nu hat (MLE)                                                                                                                             |   | 168.6  |   | nu star (bias corrected)                                        |   |   |   |   | 133.8  |   |
| 4379 | MLE Mean (bias corrected)                                                                                                                |   | 0.355  |   | MLE Sd (bias corrected)                                         |   |   |   |   | 0.162  |   |
| 4380 |                                                                                                                                          |   |        |   | Approximate Chi Square Value (0.05)                             |   |   |   |   | 108.1  |   |
| 4381 | Adjusted Level of Significance                                                                                                           |   | 0.0312 |   | Adjusted Chi Square Value                                       |   |   |   |   | 105    |   |
| 4382 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |   |        |   |
| 4383 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |        |   |                                                                 |   |   |   |   |        |   |
| 4384 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   | 0.439  |   | 95% Adjusted Gamma UCL (use when n<50)                          |   |   |   |   | 0.452  |   |
| 4385 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |   |        |   |
| 4386 | <b>Lognormal GOF Test</b>                                                                                                                |   |        |   |                                                                 |   |   |   |   |        |   |
| 4387 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.908  |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |   |   |        |   |
| 4388 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.874  |   | Data appear Lognormal at 5% Significance Level                  |   |   |   |   |        |   |
| 4389 | Lilliefors Test Statistic                                                                                                                |   | 0.156  |   | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |   |   |        |   |
| 4390 | 5% Lilliefors Critical Value                                                                                                             |   | 0.226  |   | Data appear Lognormal at 5% Significance Level                  |   |   |   |   |        |   |
| 4391 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |        |   |                                                                 |   |   |   |   |        |   |
| 4392 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |   |        |   |
| 4393 | <b>Lognormal Statistics</b>                                                                                                              |   |        |   |                                                                 |   |   |   |   |        |   |
| 4394 | Minimum of Logged Data                                                                                                                   |   | -2.333 |   | Mean of logged Data                                             |   |   |   |   | -1.122 |   |
| 4395 | Maximum of Logged Data                                                                                                                   |   | -0.371 |   | SD of logged Data                                               |   |   |   |   | 0.461  |   |
| 4396 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |   |        |   |
| 4397 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |        |   |                                                                 |   |   |   |   |        |   |
| 4398 | 95% H-UCL                                                                                                                                |   | 0.468  |   | 90% Chebyshev (MVUE) UCL                                        |   |   |   |   | 0.495  |   |
| 4399 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 0.557  |   | 97.5% Chebyshev (MVUE) UCL                                      |   |   |   |   | 0.643  |   |
| 4400 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 0.811  |   |                                                                 |   |   |   |   |        |   |
| 4401 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |   |        |   |
| 4402 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |        |   |                                                                 |   |   |   |   |        |   |
| 4403 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |        |   |                                                                 |   |   |   |   |        |   |
| 4404 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |   |        |   |
| 4405 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |        |   |                                                                 |   |   |   |   |        |   |
| 4406 | 95% CLT UCL                                                                                                                              |   | 0.416  |   | 95% Jackknife UCL                                               |   |   |   |   | 0.421  |   |
| 4407 | 95% Standard Bootstrap UCL                                                                                                               |   | 0.414  |   | 95% Bootstrap-t UCL                                             |   |   |   |   | 0.426  |   |
| 4408 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 0.442  |   | 95% Percentile Bootstrap UCL                                    |   |   |   |   | 0.419  |   |
| 4409 | 95% BCA Bootstrap UCL                                                                                                                    |   | 0.419  |   |                                                                 |   |   |   |   |        |   |
| 4410 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 0.467  |   | 95% Chebyshev(Mean, Sd) UCL                                     |   |   |   |   | 0.518  |   |
| 4411 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 0.589  |   | 99% Chebyshev(Mean, Sd) UCL                                     |   |   |   |   | 0.728  |   |
| 4412 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |   |        |   |
| 4413 | <b>Suggested UCL to Use</b>                                                                                                              |   |        |   |                                                                 |   |   |   |   |        |   |
| 4414 | 95% Student's-t UCL                                                                                                                      |   | 0.421  |   |                                                                 |   |   |   |   |        |   |
| 4415 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |   |        |   |
| 4416 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |   |                                                                 |   |   |   |   |        |   |
| 4417 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |   |                                                                 |   |   |   |   |        |   |
| 4418 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |   |                                                                 |   |   |   |   |        |   |
| 4419 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |   |                                                                 |   |   |   |   |        |   |
| 4420 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |   |        |   |
| 4421 |                                                                                                                                          |   |        |   |                                                                 |   |   |   |   |        |   |
| 4422 | <b>Result (eu3_zinc_overbank)</b>                                                                                                        |   |        |   |                                                                 |   |   |   |   |        |   |

| A    | B                                                           | C      | D                                                   | E | F | G                                       | H | I                                        | J     | K | L |  |
|------|-------------------------------------------------------------|--------|-----------------------------------------------------|---|---|-----------------------------------------|---|------------------------------------------|-------|---|---|--|
| 4423 |                                                             |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4424 | <b>General Statistics</b>                                   |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4425 | Total Number of Observations                                | 62     |                                                     |   |   |                                         |   | Number of Distinct Observations          | 57    |   |   |  |
| 4426 |                                                             |        |                                                     |   |   |                                         |   | Number of Missing Observations           | 0     |   |   |  |
| 4427 | Minimum                                                     | 18.7   |                                                     |   |   |                                         |   | Mean                                     | 591.4 |   |   |  |
| 4428 | Maximum                                                     | 5560   |                                                     |   |   |                                         |   | Median                                   | 368.5 |   |   |  |
| 4429 | SD                                                          | 978.6  |                                                     |   |   |                                         |   | Std. Error of Mean                       | 124.3 |   |   |  |
| 4430 | Coefficient of Variation                                    | 1.655  |                                                     |   |   |                                         |   | Skewness                                 | 4.183 |   |   |  |
| 4431 |                                                             |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4432 | <b>Normal GOF Test</b>                                      |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4433 | Shapiro Wilk Test Statistic                                 | 0.499  |                                                     |   |   |                                         |   | <b>Shapiro Wilk GOF Test</b>             |       |   |   |  |
| 4434 | 5% Shapiro Wilk P Value                                     | 0      | Data Not Normal at 5% Significance Level            |   |   |                                         |   |                                          |       |   |   |  |
| 4435 | Lilliefors Test Statistic                                   | 0.294  |                                                     |   |   |                                         |   | <b>Lilliefors GOF Test</b>               |       |   |   |  |
| 4436 | 5% Lilliefors Critical Value                                | 0.112  | Data Not Normal at 5% Significance Level            |   |   |                                         |   |                                          |       |   |   |  |
| 4437 | <b>Data Not Normal at 5% Significance Level</b>             |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4438 |                                                             |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4439 | <b>Assuming Normal Distribution</b>                         |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4440 | <b>95% Normal UCL</b>                                       |        |                                                     |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |                                          |       |   |   |  |
| 4441 | 95% Student's-t UCL                                         | 799    |                                                     |   |   |                                         |   | 95% Adjusted-CLT UCL (Chen-1995)         | 866.4 |   |   |  |
| 4442 |                                                             |        |                                                     |   |   |                                         |   | 95% Modified-t UCL (Johnson-1978)        | 810   |   |   |  |
| 4443 |                                                             |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4444 | <b>Gamma GOF Test</b>                                       |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4445 | A-D Test Statistic                                          | 1.357  |                                                     |   |   |                                         |   | <b>Anderson-Darling Gamma GOF Test</b>   |       |   |   |  |
| 4446 | 5% A-D Critical Value                                       | 0.789  | Data Not Gamma Distributed at 5% Significance Level |   |   |                                         |   |                                          |       |   |   |  |
| 4447 | K-S Test Statistic                                          | 0.139  |                                                     |   |   |                                         |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b> |       |   |   |  |
| 4448 | 5% K-S Critical Value                                       | 0.117  | Data Not Gamma Distributed at 5% Significance Level |   |   |                                         |   |                                          |       |   |   |  |
| 4449 | <b>Data Not Gamma Distributed at 5% Significance Level</b>  |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4450 |                                                             |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4451 | <b>Gamma Statistics</b>                                     |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4452 | k hat (MLE)                                                 | 0.81   |                                                     |   |   |                                         |   | k star (bias corrected MLE)              | 0.782 |   |   |  |
| 4453 | Theta hat (MLE)                                             | 729.7  |                                                     |   |   |                                         |   | Theta star (bias corrected MLE)          | 756.2 |   |   |  |
| 4454 | nu hat (MLE)                                                | 100.5  |                                                     |   |   |                                         |   | nu star (bias corrected)                 | 96.97 |   |   |  |
| 4455 | MLE Mean (bias corrected)                                   | 591.4  |                                                     |   |   |                                         |   | MLE Sd (bias corrected)                  | 668.7 |   |   |  |
| 4456 |                                                             |        |                                                     |   |   |                                         |   | Approximate Chi Square Value (0.05)      | 75.26 |   |   |  |
| 4457 | Adjusted Level of Significance                              | 0.0461 |                                                     |   |   |                                         |   | Adjusted Chi Square Value                | 74.8  |   |   |  |
| 4458 |                                                             |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4459 | <b>Assuming Gamma Distribution</b>                          |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4460 | 95% Approximate Gamma UCL (use when n>=50))                 | 762    |                                                     |   |   |                                         |   | 95% Adjusted Gamma UCL (use when n<50)   | 766.6 |   |   |  |
| 4461 |                                                             |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4462 | <b>Lognormal GOF Test</b>                                   |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4463 | Shapiro Wilk Test Statistic                                 | 0.952  |                                                     |   |   |                                         |   | <b>Shapiro Wilk Lognormal GOF Test</b>   |       |   |   |  |
| 4464 | 5% Shapiro Wilk P Value                                     | 0.0337 | Data Not Lognormal at 5% Significance Level         |   |   |                                         |   |                                          |       |   |   |  |
| 4465 | Lilliefors Test Statistic                                   | 0.124  |                                                     |   |   |                                         |   | <b>Lilliefors Lognormal GOF Test</b>     |       |   |   |  |
| 4466 | 5% Lilliefors Critical Value                                | 0.112  | Data Not Lognormal at 5% Significance Level         |   |   |                                         |   |                                          |       |   |   |  |
| 4467 | <b>Data Not Lognormal at 5% Significance Level</b>          |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4468 |                                                             |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4469 | <b>Lognormal Statistics</b>                                 |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4470 | Minimum of Logged Data                                      | 2.929  |                                                     |   |   |                                         |   | Mean of logged Data                      | 5.651 |   |   |  |
| 4471 | Maximum of Logged Data                                      | 8.623  |                                                     |   |   |                                         |   | SD of logged Data                        | 1.259 |   |   |  |
| 4472 |                                                             |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4473 | <b>Assuming Lognormal Distribution</b>                      |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4474 | 95% H-UCL                                                   | 904.8  |                                                     |   |   |                                         |   | 90% Chebyshev (MVUE) UCL                 | 989.5 |   |   |  |
| 4475 | 95% Chebyshev (MVUE) UCL                                    | 1159   |                                                     |   |   |                                         |   | 97.5% Chebyshev (MVUE) UCL               | 1394  |   |   |  |
| 4476 | 99% Chebyshev (MVUE) UCL                                    | 1857   |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4477 |                                                             |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4478 | <b>Nonparametric Distribution Free UCL Statistics</b>       |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4479 | <b>Data do not follow a Discernible Distribution (0.05)</b> |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4480 |                                                             |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4481 | <b>Nonparametric Distribution Free UCLs</b>                 |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4482 | 95% CLT UCL                                                 | 795.8  |                                                     |   |   |                                         |   | 95% Jackknife UCL                        | 799   |   |   |  |
| 4483 | 95% Standard Bootstrap UCL                                  | 793.8  |                                                     |   |   |                                         |   | 95% Bootstrap-t UCL                      | 1072  |   |   |  |
| 4484 | 95% Hall's Bootstrap UCL                                    | 1800   |                                                     |   |   |                                         |   | 95% Percentile Bootstrap UCL             | 802.5 |   |   |  |
| 4485 | 95% BCA Bootstrap UCL                                       | 883.8  |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4486 | 90% Chebyshev(Mean, Sd) UCL                                 | 964.2  |                                                     |   |   |                                         |   | 95% Chebyshev(Mean, Sd) UCL              | 1133  |   |   |  |
| 4487 | 97.5% Chebyshev(Mean, Sd) UCL                               | 1368   |                                                     |   |   |                                         |   | 99% Chebyshev(Mean, Sd) UCL              | 1828  |   |   |  |
| 4488 |                                                             |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |
| 4489 | <b>Suggested UCL to Use</b>                                 |        |                                                     |   |   |                                         |   |                                          |       |   |   |  |

| A    | B                                                                                                                                        | C | D | E      | F                                                               | G | H | I     | J | K | L |  |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------------------|---|---|-------|---|---|---|--|--|
| 4490 | 95% Chebyshev (Mean, Sd) UCL                                                                                                             |   |   | 1133   |                                                                 |   |   |       |   |   |   |  |  |
| 4491 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4492 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4493 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4494 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4495 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4496 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4497 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4498 | <b>Result (eu3_zinc_waste rock)</b>                                                                                                      |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4499 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4500 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4501 | Total Number of Observations                                                                                                             |   |   | 14     | Number of Distinct Observations                                 |   |   | 14    |   |   |   |  |  |
| 4502 |                                                                                                                                          |   |   |        | Number of Missing Observations                                  |   |   | 0     |   |   |   |  |  |
| 4503 | Minimum                                                                                                                                  |   |   | 223    | Mean                                                            |   |   | 4002  |   |   |   |  |  |
| 4504 | Maximum                                                                                                                                  |   |   | 17900  | Median                                                          |   |   | 942   |   |   |   |  |  |
| 4505 | SD                                                                                                                                       |   |   | 5899   | Std. Error of Mean                                              |   |   | 1577  |   |   |   |  |  |
| 4506 | Coefficient of Variation                                                                                                                 |   |   | 1.474  | Skewness                                                        |   |   | 1.65  |   |   |   |  |  |
| 4507 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4508 | <b>Normal GOF Test</b>                                                                                                                   |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4509 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.694  | <b>Shapiro Wilk GOF Test</b>                                    |   |   |       |   |   |   |  |  |
| 4510 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.874  | Data Not Normal at 5% Significance Level                        |   |   |       |   |   |   |  |  |
| 4511 | Lilliefors Test Statistic                                                                                                                |   |   | 0.298  | <b>Lilliefors GOF Test</b>                                      |   |   |       |   |   |   |  |  |
| 4512 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.226  | Data Not Normal at 5% Significance Level                        |   |   |       |   |   |   |  |  |
| 4513 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4514 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4515 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4516 | <b>95% Normal UCL</b>                                                                                                                    |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |       |   |   |   |  |  |
| 4517 | 95% Student's-t UCL                                                                                                                      |   |   | 6794   | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   | 7338  |   |   |   |  |  |
| 4518 |                                                                                                                                          |   |   |        | 95% Modified-t UCL (Johnson-1978)                               |   |   | 6910  |   |   |   |  |  |
| 4519 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4520 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4521 | A-D Test Statistic                                                                                                                       |   |   | 0.895  | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |       |   |   |   |  |  |
| 4522 | 5% A-D Critical Value                                                                                                                    |   |   | 0.788  | Data Not Gamma Distributed at 5% Significance Level             |   |   |       |   |   |   |  |  |
| 4523 | K-S Test Statistic                                                                                                                       |   |   | 0.209  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |       |   |   |   |  |  |
| 4524 | 5% K-S Critical Value                                                                                                                    |   |   | 0.241  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |  |  |
| 4525 | <b>Detected data follow Appr. Gamma Distribution at 5% Significance Level</b>                                                            |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4526 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4527 | <b>Gamma Statistics</b>                                                                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4528 | k hat (MLE)                                                                                                                              |   |   | 0.56   | k star (bias corrected MLE)                                     |   |   | 0.488 |   |   |   |  |  |
| 4529 | Theta hat (MLE)                                                                                                                          |   |   | 7143   | Theta star (bias corrected MLE)                                 |   |   | 8204  |   |   |   |  |  |
| 4530 | nu hat (MLE)                                                                                                                             |   |   | 15.69  | nu star (bias corrected)                                        |   |   | 13.66 |   |   |   |  |  |
| 4531 | MLE Mean (bias corrected)                                                                                                                |   |   | 4002   | MLE Sd (bias corrected)                                         |   |   | 5730  |   |   |   |  |  |
| 4532 |                                                                                                                                          |   |   |        | Approximate Chi Square Value (0.05)                             |   |   | 6.338 |   |   |   |  |  |
| 4533 | Adjusted Level of Significance                                                                                                           |   |   | 0.0312 | Adjusted Chi Square Value                                       |   |   | 5.689 |   |   |   |  |  |
| 4534 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4535 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4536 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   |   | 8624   | 95% Adjusted Gamma UCL (use when n<50)                          |   |   | 9608  |   |   |   |  |  |
| 4537 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4538 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4539 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.888  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |       |   |   |   |  |  |
| 4540 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.874  | Data appear Lognormal at 5% Significance Level                  |   |   |       |   |   |   |  |  |
| 4541 | Lilliefors Test Statistic                                                                                                                |   |   | 0.197  | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |       |   |   |   |  |  |
| 4542 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.226  | Data appear Lognormal at 5% Significance Level                  |   |   |       |   |   |   |  |  |
| 4543 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4544 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4545 | <b>Lognormal Statistics</b>                                                                                                              |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4546 | Minimum of Logged Data                                                                                                                   |   |   | 5.407  | Mean of logged Data                                             |   |   | 7.18  |   |   |   |  |  |
| 4547 | Maximum of Logged Data                                                                                                                   |   |   | 9.793  | SD of logged Data                                               |   |   | 1.587 |   |   |   |  |  |
| 4548 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4549 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4550 | 95% H-UCL                                                                                                                                |   |   | 25303  | 90% Chebyshev (MVUE) UCL                                        |   |   | 9548  |   |   |   |  |  |
| 4551 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 12099  | 97.5% Chebyshev (MVUE) UCL                                      |   |   | 15641 |   |   |   |  |  |
| 4552 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 22598  |                                                                 |   |   |       |   |   |   |  |  |
| 4553 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4554 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4555 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |        |                                                                 |   |   |       |   |   |   |  |  |
| 4556 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |  |  |

| A    | B                                                                                                                                        | C | D | E      | F                                                            | G | H | I      | J | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|--------------------------------------------------------------|---|---|--------|---|---|---|--|
| 4557 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4558 | 95% CLT UCL                                                                                                                              |   |   | 6595   | 95% Jackknife UCL                                            |   |   | 6794   |   |   |   |  |
| 4559 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 6425   | 95% Bootstrap-t UCL                                          |   |   | 9032   |   |   |   |  |
| 4560 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 7110   | 95% Percentile Bootstrap UCL                                 |   |   | 6623   |   |   |   |  |
| 4561 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 7498   |                                                              |   |   |        |   |   |   |  |
| 4562 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 8732   | 95% Chebyshev(Mean, Sd) UCL                                  |   |   | 10874  |   |   |   |  |
| 4563 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 13848  | 99% Chebyshev(Mean, Sd) UCL                                  |   |   | 19690  |   |   |   |  |
| 4564 |                                                                                                                                          |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4565 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4566 | 95% Adjusted Gamma UCL                                                                                                                   |   |   | 9608   |                                                              |   |   |        |   |   |   |  |
| 4567 |                                                                                                                                          |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4568 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                           |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4569 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                   |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4570 |                                                                                                                                          |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4571 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4572 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4573 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4574 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4575 |                                                                                                                                          |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4576 | <b>Result (eu4_antimony_overbank)</b>                                                                                                    |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4577 |                                                                                                                                          |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4578 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4579 | Total Number of Observations                                                                                                             |   |   | 49     | Number of Distinct Observations                              |   |   | 41     |   |   |   |  |
| 4580 | Number of Detects                                                                                                                        |   |   | 41     | Number of Non-Detects                                        |   |   | 8      |   |   |   |  |
| 4581 | Number of Distinct Detects                                                                                                               |   |   | 35     | Number of Distinct Non-Detects                               |   |   | 6      |   |   |   |  |
| 4582 | Minimum Detect                                                                                                                           |   |   | 0.11   | Minimum Non-Detect                                           |   |   | 0.034  |   |   |   |  |
| 4583 | Maximum Detect                                                                                                                           |   |   | 9.9    | Maximum Non-Detect                                           |   |   | 0.073  |   |   |   |  |
| 4584 | Variance Detects                                                                                                                         |   |   | 3.961  | Percent Non-Detects                                          |   |   | 16.33% |   |   |   |  |
| 4585 | Mean Detects                                                                                                                             |   |   | 1.345  | SD Detects                                                   |   |   | 1.99   |   |   |   |  |
| 4586 | Median Detects                                                                                                                           |   |   | 0.74   | CV Detects                                                   |   |   | 1.48   |   |   |   |  |
| 4587 | Skewness Detects                                                                                                                         |   |   | 3.568  | Kurtosis Detects                                             |   |   | 13.12  |   |   |   |  |
| 4588 | Mean of Logged Detects                                                                                                                   |   |   | -0.236 | SD of Logged Detects                                         |   |   | 0.981  |   |   |   |  |
| 4589 |                                                                                                                                          |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4590 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4591 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.526  | <b>Shapiro Wilk GOF Test</b>                                 |   |   |        |   |   |   |  |
| 4592 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.941  | Detected Data Not Normal at 5% Significance Level            |   |   |        |   |   |   |  |
| 4593 | Lilliefors Test Statistic                                                                                                                |   |   | 0.285  | <b>Lilliefors GOF Test</b>                                   |   |   |        |   |   |   |  |
| 4594 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.137  | Detected Data Not Normal at 5% Significance Level            |   |   |        |   |   |   |  |
| 4595 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4596 |                                                                                                                                          |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4597 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4598 | KM Mean                                                                                                                                  |   |   | 1.131  | KM Standard Error of Mean                                    |   |   | 0.269  |   |   |   |  |
| 4599 | KM SD                                                                                                                                    |   |   | 1.862  | 95% KM (BCA) UCL                                             |   |   | 1.621  |   |   |   |  |
| 4600 | 95% KM (t) UCL                                                                                                                           |   |   | 1.583  | 95% KM (Percentile Bootstrap) UCL                            |   |   | 1.635  |   |   |   |  |
| 4601 | 95% KM (z) UCL                                                                                                                           |   |   | 1.574  | 95% KM Bootstrap t UCL                                       |   |   | 2.22   |   |   |   |  |
| 4602 | 90% KM Chebyshev UCL                                                                                                                     |   |   | 1.939  | 95% KM Chebyshev UCL                                         |   |   | 2.305  |   |   |   |  |
| 4603 | 97.5% KM Chebyshev UCL                                                                                                                   |   |   | 2.813  | 99% KM Chebyshev UCL                                         |   |   | 3.811  |   |   |   |  |
| 4604 |                                                                                                                                          |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4605 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4606 | A-D Test Statistic                                                                                                                       |   |   | 1.684  | <b>Anderson-Darling GOF Test</b>                             |   |   |        |   |   |   |  |
| 4607 | 5% A-D Critical Value                                                                                                                    |   |   | 0.777  | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |        |   |   |   |  |
| 4608 | K-S Test Statistic                                                                                                                       |   |   | 0.172  | <b>Kolmogorov-Smirnov GOF</b>                                |   |   |        |   |   |   |  |
| 4609 | 5% K-S Critical Value                                                                                                                    |   |   | 0.142  | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |        |   |   |   |  |
| 4610 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                                      |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4611 |                                                                                                                                          |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4612 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4613 | k hat (MLE)                                                                                                                              |   |   | 1.075  | k star (bias corrected MLE)                                  |   |   | 1.013  |   |   |   |  |
| 4614 | Theta hat (MLE)                                                                                                                          |   |   | 1.251  | Theta star (bias corrected MLE)                              |   |   | 1.328  |   |   |   |  |
| 4615 | nu hat (MLE)                                                                                                                             |   |   | 88.16  | nu star (bias corrected)                                     |   |   | 83.04  |   |   |   |  |
| 4616 | Mean (detects)                                                                                                                           |   |   | 1.345  |                                                              |   |   |        |   |   |   |  |
| 4617 |                                                                                                                                          |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4618 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4619 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4620 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4621 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4622 | This is especially true when the sample size is small.                                                                                   |   |   |        |                                                              |   |   |        |   |   |   |  |
| 4623 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |   |   |        |                                                              |   |   |        |   |   |   |  |

|      | A | B | C | D | E                                                                                                                                        | F      | G | H                           | I | J                                                              | K      | L      |
|------|---|---|---|---|------------------------------------------------------------------------------------------------------------------------------------------|--------|---|-----------------------------|---|----------------------------------------------------------------|--------|--------|
| 4624 |   |   |   |   | Minimum                                                                                                                                  | 0.01   |   |                             |   |                                                                | Mean   | 1.127  |
| 4625 |   |   |   |   | Maximum                                                                                                                                  | 9.9    |   |                             |   |                                                                | Median | 0.63   |
| 4626 |   |   |   |   | SD                                                                                                                                       | 1.884  |   |                             |   |                                                                | CV     | 1.671  |
| 4627 |   |   |   |   | k hat (MLE)                                                                                                                              | 0.581  |   |                             |   | k star (bias corrected MLE)                                    |        | 0.559  |
| 4628 |   |   |   |   | Theta hat (MLE)                                                                                                                          | 1.941  |   |                             |   | Theta star (bias corrected MLE)                                |        | 2.017  |
| 4629 |   |   |   |   | nu hat (MLE)                                                                                                                             | 56.92  |   |                             |   | nu star (bias corrected)                                       |        | 54.77  |
| 4630 |   |   |   |   | Adjusted Level of Significance ( $\beta$ )                                                                                               | 0.0451 |   |                             |   |                                                                |        |        |
| 4631 |   |   |   |   | Approximate Chi Square Value (54.77, $\alpha$ )                                                                                          | 38.76  |   |                             |   | Adjusted Chi Square Value (54.77, $\beta$ )                    |        | 38.35  |
| 4632 |   |   |   |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                                        | 1.593  |   |                             |   | 95% Gamma Adjusted UCL (use when $n < 50$ )                    |        | 1.61   |
| 4633 |   |   |   |   | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |        |   |                             |   |                                                                |        |        |
| 4634 |   |   |   |   | Mean (KM)                                                                                                                                | 1.131  |   |                             |   | SD (KM)                                                        |        | 1.862  |
| 4635 |   |   |   |   | Variance (KM)                                                                                                                            | 3.468  |   |                             |   | SE of Mean (KM)                                                |        | 0.269  |
| 4636 |   |   |   |   | k hat (KM)                                                                                                                               | 0.369  |   |                             |   | k star (KM)                                                    |        | 0.36   |
| 4637 |   |   |   |   | nu hat (KM)                                                                                                                              | 36.15  |   |                             |   | nu star (KM)                                                   |        | 35.27  |
| 4638 |   |   |   |   | theta hat (KM)                                                                                                                           | 3.066  |   |                             |   | theta star (KM)                                                |        | 3.143  |
| 4639 |   |   |   |   | 80% gamma percentile (KM)                                                                                                                | 1.799  |   |                             |   | 90% gamma percentile (KM)                                      |        | 3.252  |
| 4640 |   |   |   |   | 95% gamma percentile (KM)                                                                                                                | 4.872  |   |                             |   | 99% gamma percentile (KM)                                      |        | 8.994  |
| 4641 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                                |        |        |
| 4642 |   |   |   |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |        |   |                             |   |                                                                |        |        |
| 4643 |   |   |   |   | Approximate Chi Square Value (35.27, $\alpha$ )                                                                                          | 22.68  |   |                             |   | Adjusted Chi Square Value (35.27, $\beta$ )                    |        | 22.37  |
| 4644 |   |   |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                      | 1.759  |   |                             |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )                 |        | 1.783  |
| 4645 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                                |        |        |
| 4646 |   |   |   |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |        |   |                             |   |                                                                |        |        |
| 4647 |   |   |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.956  |   |                             |   | <b>Shapiro Wilk GOF Test</b>                                   |        |        |
| 4648 |   |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                           | 0.941  |   |                             |   | Detected Data appear Lognormal at 5% Significance Level        |        |        |
| 4649 |   |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.0911 |   |                             |   | <b>Lilliefors GOF Test</b>                                     |        |        |
| 4650 |   |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.137  |   |                             |   | Detected Data appear Lognormal at 5% Significance Level        |        |        |
| 4651 |   |   |   |   |                                                                                                                                          |        |   |                             |   | <b>Detected Data appear Lognormal at 5% Significance Level</b> |        |        |
| 4652 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                                |        |        |
| 4653 |   |   |   |   | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |        |   |                             |   |                                                                |        |        |
| 4654 |   |   |   |   | Mean in Original Scale                                                                                                                   | 1.141  |   |                             |   | Mean in Log Scale                                              |        | -0.585 |
| 4655 |   |   |   |   | SD in Original Scale                                                                                                                     | 1.876  |   |                             |   | SD in Log Scale                                                |        | 1.202  |
| 4656 |   |   |   |   | 95% t UCL (assumes normality of ROS data)                                                                                                | 1.59   |   |                             |   | 95% Percentile Bootstrap UCL                                   |        | 1.63   |
| 4657 |   |   |   |   | 95% BCA Bootstrap UCL                                                                                                                    | 1.784  |   |                             |   | 95% Bootstrap t UCL                                            |        | 2.193  |
| 4658 |   |   |   |   | 95% H-UCL (Log ROS)                                                                                                                      | 1.791  |   |                             |   |                                                                |        |        |
| 4659 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                                |        |        |
| 4660 |   |   |   |   | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |        |   |                             |   |                                                                |        |        |
| 4661 |   |   |   |   | KM Mean (logged)                                                                                                                         | -0.749 |   |                             |   | KM Geo Mean                                                    |        | 0.473  |
| 4662 |   |   |   |   | KM SD (logged)                                                                                                                           | 1.462  |   |                             |   | 95% Critical H Value (KM-Log)                                  |        | 2.886  |
| 4663 |   |   |   |   | KM Standard Error of Mean (logged)                                                                                                       | 0.211  |   |                             |   | 95% H-UCL (KM -Log)                                            |        | 2.53   |
| 4664 |   |   |   |   | KM SD (logged)                                                                                                                           | 1.462  |   |                             |   | 95% Critical H Value (KM-Log)                                  |        | 2.886  |
| 4665 |   |   |   |   | KM Standard Error of Mean (logged)                                                                                                       | 0.211  |   |                             |   |                                                                |        |        |
| 4666 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                                |        |        |
| 4667 |   |   |   |   | <b>DL/2 Statistics</b>                                                                                                                   |        |   |                             |   |                                                                |        |        |
| 4668 |   |   |   |   | <b>DL/2 Normal</b>                                                                                                                       |        |   | <b>DL/2 Log-Transformed</b> |   |                                                                |        |        |
| 4669 |   |   |   |   | Mean in Original Scale                                                                                                                   | 1.129  |   |                             |   | Mean in Log Scale                                              |        | -0.834 |
| 4670 |   |   |   |   | SD in Original Scale                                                                                                                     | 1.883  |   |                             |   | SD in Log Scale                                                |        | 1.638  |
| 4671 |   |   |   |   | 95% t UCL (Assumes normality)                                                                                                            | 1.58   |   |                             |   | 95% H-Stat UCL                                                 |        | 3.471  |
| 4672 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                                |        |        |
| 4673 |   |   |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |        |   |                             |   |                                                                |        |        |
| 4674 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                                |        |        |
| 4675 |   |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |   |                             |   |                                                                |        |        |
| 4676 |   |   |   |   | <b>Detected Data appear Lognormal Distributed at 5% Significance Level</b>                                                               |        |   |                             |   |                                                                |        |        |
| 4677 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                                |        |        |
| 4678 |   |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |        |   |                             |   |                                                                |        |        |
| 4679 |   |   |   |   | KM H-UCL                                                                                                                                 | 2.53   |   |                             |   |                                                                |        |        |
| 4680 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                                |        |        |
| 4681 |   |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |   |                             |   |                                                                |        |        |
| 4682 |   |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |   |                             |   |                                                                |        |        |
| 4683 |   |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |   |                             |   |                                                                |        |        |
| 4684 |   |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |   |                             |   |                                                                |        |        |
| 4685 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                                |        |        |
| 4686 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                                |        |        |
| 4687 |   |   |   |   | <b>Result (eu4_antimony_waste rock)</b>                                                                                                  |        |   |                             |   |                                                                |        |        |
| 4688 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                                |        |        |
| 4689 |   |   |   |   | <b>General Statistics</b>                                                                                                                |        |   |                             |   |                                                                |        |        |
| 4690 |   |   |   |   | Total Number of Observations                                                                                                             | 15     |   |                             |   | Number of Distinct Observations                                |        | 14     |

| A    | B | C | D | E                                                                                                                            | F      | G | H | I                                       | J     | K                                                               | L     |
|------|---|---|---|------------------------------------------------------------------------------------------------------------------------------|--------|---|---|-----------------------------------------|-------|-----------------------------------------------------------------|-------|
| 4691 |   |   |   |                                                                                                                              |        |   |   |                                         |       | Number of Missing Observations                                  | 0     |
| 4692 |   |   |   | Minimum                                                                                                                      | 0.57   |   |   |                                         |       | Mean                                                            | 35.33 |
| 4693 |   |   |   | Maximum                                                                                                                      | 176    |   |   |                                         |       | Median                                                          | 16.8  |
| 4694 |   |   |   | SD                                                                                                                           | 49.88  |   |   |                                         |       | Std. Error of Mean                                              | 12.88 |
| 4695 |   |   |   | Coefficient of Variation                                                                                                     | 1.412  |   |   |                                         |       | Skewness                                                        | 2.085 |
| 4696 |   |   |   |                                                                                                                              |        |   |   |                                         |       |                                                                 |       |
| 4697 |   |   |   | <b>Normal GOF Test</b>                                                                                                       |        |   |   |                                         |       |                                                                 |       |
| 4698 |   |   |   | Shapiro Wilk Test Statistic                                                                                                  | 0.711  |   |   |                                         |       | <b>Shapiro Wilk GOF Test</b>                                    |       |
| 4699 |   |   |   | 5% Shapiro Wilk Critical Value                                                                                               | 0.881  |   |   |                                         |       | Data Not Normal at 5% Significance Level                        |       |
| 4700 |   |   |   | Lilliefors Test Statistic                                                                                                    | 0.269  |   |   |                                         |       | <b>Lilliefors GOF Test</b>                                      |       |
| 4701 |   |   |   | 5% Lilliefors Critical Value                                                                                                 | 0.22   |   |   |                                         |       | Data Not Normal at 5% Significance Level                        |       |
| 4702 |   |   |   | <b>Data Not Normal at 5% Significance Level</b>                                                                              |        |   |   |                                         |       |                                                                 |       |
| 4703 |   |   |   |                                                                                                                              |        |   |   |                                         |       |                                                                 |       |
| 4704 |   |   |   | <b>Assuming Normal Distribution</b>                                                                                          |        |   |   |                                         |       |                                                                 |       |
| 4705 |   |   |   | <b>95% Normal UCL</b>                                                                                                        |        |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |       |                                                                 |       |
| 4706 |   |   |   | 95% Student's-t UCL                                                                                                          | 58.01  |   |   | 95% Adjusted-CLT UCL (Chen-1995)        | 63.92 |                                                                 |       |
| 4707 |   |   |   |                                                                                                                              |        |   |   | 95% Modified-t UCL (Johnson-1978)       | 59.17 |                                                                 |       |
| 4708 |   |   |   |                                                                                                                              |        |   |   |                                         |       |                                                                 |       |
| 4709 |   |   |   | <b>Gamma GOF Test</b>                                                                                                        |        |   |   |                                         |       |                                                                 |       |
| 4710 |   |   |   | A-D Test Statistic                                                                                                           | 0.321  |   |   |                                         |       | <b>Anderson-Darling Gamma GOF Test</b>                          |       |
| 4711 |   |   |   | 5% A-D Critical Value                                                                                                        | 0.784  |   |   |                                         |       | Detected data appear Gamma Distributed at 5% Significance Level |       |
| 4712 |   |   |   | K-S Test Statistic                                                                                                           | 0.147  |   |   |                                         |       | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |       |
| 4713 |   |   |   | 5% K-S Critical Value                                                                                                        | 0.232  |   |   |                                         |       | Detected data appear Gamma Distributed at 5% Significance Level |       |
| 4714 |   |   |   | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                       |        |   |   |                                         |       |                                                                 |       |
| 4715 |   |   |   |                                                                                                                              |        |   |   |                                         |       |                                                                 |       |
| 4716 |   |   |   | <b>Gamma Statistics</b>                                                                                                      |        |   |   |                                         |       |                                                                 |       |
| 4717 |   |   |   | k hat (MLE)                                                                                                                  | 0.62   |   |   | k star (bias corrected MLE)             | 0.54  |                                                                 |       |
| 4718 |   |   |   | Theta hat (MLE)                                                                                                              | 57.02  |   |   | Theta star (bias corrected MLE)         | 65.41 |                                                                 |       |
| 4719 |   |   |   | nu hat (MLE)                                                                                                                 | 18.59  |   |   | nu star (bias corrected)                | 16.21 |                                                                 |       |
| 4720 |   |   |   | MLE Mean (bias corrected)                                                                                                    | 35.33  |   |   | MLE Sd (bias corrected)                 | 48.07 |                                                                 |       |
| 4721 |   |   |   |                                                                                                                              |        |   |   | Approximate Chi Square Value (0.05)     | 8.107 |                                                                 |       |
| 4722 |   |   |   | Adjusted Level of Significance                                                                                               | 0.0324 |   |   | Adjusted Chi Square Value               | 7.411 |                                                                 |       |
| 4723 |   |   |   |                                                                                                                              |        |   |   |                                         |       |                                                                 |       |
| 4724 |   |   |   | <b>Assuming Gamma Distribution</b>                                                                                           |        |   |   |                                         |       |                                                                 |       |
| 4725 |   |   |   | 95% Approximate Gamma UCL (use when n>=50)                                                                                   | 70.62  |   |   | 95% Adjusted Gamma UCL (use when n<50)  | 77.26 |                                                                 |       |
| 4726 |   |   |   |                                                                                                                              |        |   |   |                                         |       |                                                                 |       |
| 4727 |   |   |   | <b>Lognormal GOF Test</b>                                                                                                    |        |   |   |                                         |       |                                                                 |       |
| 4728 |   |   |   | Shapiro Wilk Test Statistic                                                                                                  | 0.971  |   |   |                                         |       | <b>Shapiro Wilk Lognormal GOF Test</b>                          |       |
| 4729 |   |   |   | 5% Shapiro Wilk Critical Value                                                                                               | 0.881  |   |   |                                         |       | Data appear Lognormal at 5% Significance Level                  |       |
| 4730 |   |   |   | Lilliefors Test Statistic                                                                                                    | 0.104  |   |   |                                         |       | <b>Lilliefors Lognormal GOF Test</b>                            |       |
| 4731 |   |   |   | 5% Lilliefors Critical Value                                                                                                 | 0.22   |   |   |                                         |       | Data appear Lognormal at 5% Significance Level                  |       |
| 4732 |   |   |   | <b>Data appear Lognormal at 5% Significance Level</b>                                                                        |        |   |   |                                         |       |                                                                 |       |
| 4733 |   |   |   |                                                                                                                              |        |   |   |                                         |       |                                                                 |       |
| 4734 |   |   |   | <b>Lognormal Statistics</b>                                                                                                  |        |   |   |                                         |       |                                                                 |       |
| 4735 |   |   |   | Minimum of Logged Data                                                                                                       | -0.562 |   |   | Mean of logged Data                     | 2.572 |                                                                 |       |
| 4736 |   |   |   | Maximum of Logged Data                                                                                                       | 5.17   |   |   | SD of logged Data                       | 1.619 |                                                                 |       |
| 4737 |   |   |   |                                                                                                                              |        |   |   |                                         |       |                                                                 |       |
| 4738 |   |   |   | <b>Assuming Lognormal Distribution</b>                                                                                       |        |   |   |                                         |       |                                                                 |       |
| 4739 |   |   |   | 95% H-UCL                                                                                                                    | 254.6  |   |   | 90% Chebyshev (MVUE) UCL                | 100.1 |                                                                 |       |
| 4740 |   |   |   | 95% Chebyshev (MVUE) UCL                                                                                                     | 126.9  |   |   | 97.5% Chebyshev (MVUE) UCL              | 164   |                                                                 |       |
| 4741 |   |   |   | 99% Chebyshev (MVUE) UCL                                                                                                     | 237    |   |   |                                         |       |                                                                 |       |
| 4742 |   |   |   |                                                                                                                              |        |   |   |                                         |       |                                                                 |       |
| 4743 |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                        |        |   |   |                                         |       |                                                                 |       |
| 4744 |   |   |   | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                             |        |   |   |                                         |       |                                                                 |       |
| 4745 |   |   |   |                                                                                                                              |        |   |   |                                         |       |                                                                 |       |
| 4746 |   |   |   | <b>Nonparametric Distribution Free UCLs</b>                                                                                  |        |   |   |                                         |       |                                                                 |       |
| 4747 |   |   |   | 95% CLT UCL                                                                                                                  | 56.51  |   |   | 95% Jackknife UCL                       | 58.01 |                                                                 |       |
| 4748 |   |   |   | 95% Standard Bootstrap UCL                                                                                                   | 56     |   |   | 95% Bootstrap-t UCL                     | 87.95 |                                                                 |       |
| 4749 |   |   |   | 95% Hall's Bootstrap UCL                                                                                                     | 158.7  |   |   | 95% Percentile Bootstrap UCL            | 57.59 |                                                                 |       |
| 4750 |   |   |   | 95% BCA Bootstrap UCL                                                                                                        | 63.8   |   |   |                                         |       |                                                                 |       |
| 4751 |   |   |   | 90% Chebyshev(Mean, Sd) UCL                                                                                                  | 73.97  |   |   | 95% Chebyshev(Mean, Sd) UCL             | 91.47 |                                                                 |       |
| 4752 |   |   |   | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                | 115.8  |   |   | 99% Chebyshev(Mean, Sd) UCL             | 163.5 |                                                                 |       |
| 4753 |   |   |   |                                                                                                                              |        |   |   |                                         |       |                                                                 |       |
| 4754 |   |   |   | <b>Suggested UCL to Use</b>                                                                                                  |        |   |   |                                         |       |                                                                 |       |
| 4755 |   |   |   | 95% Adjusted Gamma UCL                                                                                                       | 77.26  |   |   |                                         |       |                                                                 |       |
| 4756 |   |   |   |                                                                                                                              |        |   |   |                                         |       |                                                                 |       |
| 4757 |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. |        |   |   |                                         |       |                                                                 |       |

| A    | B                                                                                                                                        | C      | D                                                            | E | F      | G | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------------------------------------------------------|---|--------|---|---|---|---|---|---|
| 4758 | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |                                                              |   |        |   |   |   |   |   |   |
| 4759 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |                                                              |   |        |   |   |   |   |   |   |
| 4760 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |                                                              |   |        |   |   |   |   |   |   |
| 4761 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 4762 | <b>Result (eu4_arsenic_overbank)</b>                                                                                                     |        |                                                              |   |        |   |   |   |   |   |   |
| 4763 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 4764 | <b>General Statistics</b>                                                                                                                |        |                                                              |   |        |   |   |   |   |   |   |
| 4765 | Total Number of Observations                                                                                                             | 54     | Number of Distinct Observations                              |   | 51     |   |   |   |   |   |   |
| 4766 | Number of Detects                                                                                                                        | 53     | Number of Non-Detects                                        |   | 1      |   |   |   |   |   |   |
| 4767 | Number of Distinct Detects                                                                                                               | 50     | Number of Distinct Non-Detects                               |   | 1      |   |   |   |   |   |   |
| 4768 | Minimum Detect                                                                                                                           | 3.6    | Minimum Non-Detect                                           |   | 0.14   |   |   |   |   |   |   |
| 4769 | Maximum Detect                                                                                                                           | 831    | Maximum Non-Detect                                           |   | 0.14   |   |   |   |   |   |   |
| 4770 | Variance Detects                                                                                                                         | 13553  | Percent Non-Detects                                          |   | 1.8529 |   |   |   |   |   |   |
| 4771 | Mean Detects                                                                                                                             | 43.38  | SD Detects                                                   |   | 116.4  |   |   |   |   |   |   |
| 4772 | Median Detects                                                                                                                           | 17.3   | CV Detects                                                   |   | 2.684  |   |   |   |   |   |   |
| 4773 | Skewness Detects                                                                                                                         | 6.268  | Kurtosis Detects                                             |   | 42.19  |   |   |   |   |   |   |
| 4774 | Mean of Logged Detects                                                                                                                   | 2.953  | SD of Logged Detects                                         |   | 1.033  |   |   |   |   |   |   |
| 4775 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 4776 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |        |                                                              |   |        |   |   |   |   |   |   |
| 4777 | Shapiro Wilk Test Statistic                                                                                                              | 0.317  | <b>Normal GOF Test on Detected Observations Only</b>         |   |        |   |   |   |   |   |   |
| 4778 | 5% Shapiro Wilk P Value                                                                                                                  | 0      | Detected Data Not Normal at 5% Significance Level            |   |        |   |   |   |   |   |   |
| 4779 | Lilliefors Test Statistic                                                                                                                | 0.38   | <b>Lilliefors GOF Test</b>                                   |   |        |   |   |   |   |   |   |
| 4780 | 5% Lilliefors Critical Value                                                                                                             | 0.121  | Detected Data Not Normal at 5% Significance Level            |   |        |   |   |   |   |   |   |
| 4781 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |        |                                                              |   |        |   |   |   |   |   |   |
| 4782 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 4783 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |        |                                                              |   |        |   |   |   |   |   |   |
| 4784 | KM Mean                                                                                                                                  | 42.58  | KM Standard Error of Mean                                    |   | 15.72  |   |   |   |   |   |   |
| 4785 | KM SD                                                                                                                                    | 114.4  | 95% KM (BCA) UCL                                             |   | 72.98  |   |   |   |   |   |   |
| 4786 | 95% KM (t) UCL                                                                                                                           | 68.89  | 95% KM (Percentile Bootstrap) UCL                            |   | 71.35  |   |   |   |   |   |   |
| 4787 | 95% KM (z) UCL                                                                                                                           | 68.43  | 95% KM Bootstrap t UCL                                       |   | 140.1  |   |   |   |   |   |   |
| 4788 | 90% KM Chebyshev UCL                                                                                                                     | 89.73  | 95% KM Chebyshev UCL                                         |   | 111.1  |   |   |   |   |   |   |
| 4789 | 97.5% KM Chebyshev UCL                                                                                                                   | 140.7  | 99% KM Chebyshev UCL                                         |   | 198.9  |   |   |   |   |   |   |
| 4790 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 4791 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |        |                                                              |   |        |   |   |   |   |   |   |
| 4792 | A-D Test Statistic                                                                                                                       | 4.284  | <b>Anderson-Darling GOF Test</b>                             |   |        |   |   |   |   |   |   |
| 4793 | 5% A-D Critical Value                                                                                                                    | 0.794  | Detected Data Not Gamma Distributed at 5% Significance Level |   |        |   |   |   |   |   |   |
| 4794 | K-S Test Statistic                                                                                                                       | 0.224  | <b>Kolmogorov-Smirnov GOF</b>                                |   |        |   |   |   |   |   |   |
| 4795 | 5% K-S Critical Value                                                                                                                    | 0.127  | Detected Data Not Gamma Distributed at 5% Significance Level |   |        |   |   |   |   |   |   |
| 4796 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                                      |        |                                                              |   |        |   |   |   |   |   |   |
| 4797 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 4798 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |        |                                                              |   |        |   |   |   |   |   |   |
| 4799 | k hat (MLE)                                                                                                                              | 0.735  | k star (bias corrected MLE)                                  |   | 0.706  |   |   |   |   |   |   |
| 4800 | Theta hat (MLE)                                                                                                                          | 59.02  | Theta star (bias corrected MLE)                              |   | 61.45  |   |   |   |   |   |   |
| 4801 | nu hat (MLE)                                                                                                                             | 77.91  | nu star (bias corrected)                                     |   | 74.83  |   |   |   |   |   |   |
| 4802 | Mean (detects)                                                                                                                           | 43.38  |                                                              |   |        |   |   |   |   |   |   |
| 4803 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 4804 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |        |                                                              |   |        |   |   |   |   |   |   |
| 4805 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |        |                                                              |   |        |   |   |   |   |   |   |
| 4806 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |        |                                                              |   |        |   |   |   |   |   |   |
| 4807 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |        |                                                              |   |        |   |   |   |   |   |   |
| 4808 | This is especially true when the sample size is small.                                                                                   |        |                                                              |   |        |   |   |   |   |   |   |
| 4809 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |        |                                                              |   |        |   |   |   |   |   |   |
| 4810 | Minimum                                                                                                                                  | 0.01   | Mean                                                         |   | 42.58  |   |   |   |   |   |   |
| 4811 | Maximum                                                                                                                                  | 831    | Median                                                       |   | 16.9   |   |   |   |   |   |   |
| 4812 | SD                                                                                                                                       | 115.5  | CV                                                           |   | 2.712  |   |   |   |   |   |   |
| 4813 | k hat (MLE)                                                                                                                              | 0.651  | k star (bias corrected MLE)                                  |   | 0.627  |   |   |   |   |   |   |
| 4814 | Theta hat (MLE)                                                                                                                          | 65.41  | Theta star (bias corrected MLE)                              |   | 67.89  |   |   |   |   |   |   |
| 4815 | nu hat (MLE)                                                                                                                             | 70.3   | nu star (bias corrected)                                     |   | 67.73  |   |   |   |   |   |   |
| 4816 | Adjusted Level of Significance ( $\beta$ )                                                                                               | 0.0456 |                                                              |   |        |   |   |   |   |   |   |
| 4817 | Approximate Chi Square Value (67.73, $\alpha$ )                                                                                          | 49.79  | Adjusted Chi Square Value (67.73, $\beta$ )                  |   | 49.37  |   |   |   |   |   |   |
| 4818 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                                        | 57.92  | 95% Gamma Adjusted UCL (use when $n < 50$ )                  |   | 58.42  |   |   |   |   |   |   |
| 4819 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 4820 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |        |                                                              |   |        |   |   |   |   |   |   |
| 4821 | Mean (KM)                                                                                                                                | 42.58  | SD (KM)                                                      |   | 114.4  |   |   |   |   |   |   |
| 4822 | Variance (KM)                                                                                                                            | 13085  | SE of Mean (KM)                                              |   | 15.72  |   |   |   |   |   |   |
| 4823 | k hat (KM)                                                                                                                               | 0.139  | k star (KM)                                                  |   | 0.143  |   |   |   |   |   |   |
| 4824 | nu hat (KM)                                                                                                                              | 14.97  | nu star (KM)                                                 |   | 15.47  |   |   |   |   |   |   |

|      | A                                                                                                                                        | B | C | D | E | F                                                   | G                           | H | I | J | K | L                                                       |       |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|-----------------------------------------------------|-----------------------------|---|---|---|---|---------------------------------------------------------|-------|--|
| 4825 |                                                                                                                                          |   |   |   |   | theta hat (KM)                                      | 307.3                       |   |   |   |   | theta star (KM)                                         | 297.3 |  |
| 4826 |                                                                                                                                          |   |   |   |   | 80% gamma percentile (KM)                           | 44.57                       |   |   |   |   | 90% gamma percentile (KM)                               | 125.4 |  |
| 4827 |                                                                                                                                          |   |   |   |   | 95% gamma percentile (KM)                           | 236.4                       |   |   |   |   | 99% gamma percentile (KM)                               | 561.7 |  |
| 4828 |                                                                                                                                          |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4829 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4830 |                                                                                                                                          |   |   |   |   | Approximate Chi Square Value (15.47, $\alpha$ )     | 7.588                       |   |   |   |   | Adjusted Chi Square Value (15.47, $\beta$ )             | 7.436 |  |
| 4831 |                                                                                                                                          |   |   |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ ) | 86.8                        |   |   |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )          | 88.57 |  |
| 4832 |                                                                                                                                          |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4833 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4834 |                                                                                                                                          |   |   |   |   | Shapiro Wilk Approximate Test Statistic             | 0.933                       |   |   |   |   | <b>Shapiro Wilk GOF Test</b>                            |       |  |
| 4835 |                                                                                                                                          |   |   |   |   | 5% Shapiro Wilk P Value                             | 0.00715                     |   |   |   |   | Detected Data Not Lognormal at 5% Significance Level    |       |  |
| 4836 |                                                                                                                                          |   |   |   |   | Lilliefors Test Statistic                           | 0.0911                      |   |   |   |   | <b>Lilliefors GOF Test</b>                              |       |  |
| 4837 |                                                                                                                                          |   |   |   |   | 5% Lilliefors Critical Value                        | 0.121                       |   |   |   |   | Detected Data appear Lognormal at 5% Significance Level |       |  |
| 4838 | <b>Detected Data appear Approximate Lognormal at 5% Significance Level</b>                                                               |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4839 |                                                                                                                                          |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4840 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4841 |                                                                                                                                          |   |   |   |   | Mean in Original Scale                              | 42.6                        |   |   |   |   | Mean in Log Scale                                       | 2.905 |  |
| 4842 |                                                                                                                                          |   |   |   |   | SD in Original Scale                                | 115.5                       |   |   |   |   | SD in Log Scale                                         | 1.083 |  |
| 4843 |                                                                                                                                          |   |   |   |   | 95% t UCL (assumes normality of ROS data)           | 68.91                       |   |   |   |   | 95% Percentile Bootstrap UCL                            | 69.97 |  |
| 4844 |                                                                                                                                          |   |   |   |   | 95% BCA Bootstrap UCL                               | 94.81                       |   |   |   |   | 95% Bootstrap t UCL                                     | 145.7 |  |
| 4845 |                                                                                                                                          |   |   |   |   | 95% H-UCL (Log ROS)                                 | 47.12                       |   |   |   |   |                                                         |       |  |
| 4846 |                                                                                                                                          |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4847 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4848 |                                                                                                                                          |   |   |   |   | KM Mean (logged)                                    | 2.862                       |   |   |   |   | KM Geo Mean                                             | 17.5  |  |
| 4849 |                                                                                                                                          |   |   |   |   | KM SD (logged)                                      | 1.211                       |   |   |   |   | 95% Critical H Value (KM-Log)                           | 2.61  |  |
| 4850 |                                                                                                                                          |   |   |   |   | KM Standard Error of Mean (logged)                  | 0.166                       |   |   |   |   | 95% H-UCL (KM -Log)                                     | 56.24 |  |
| 4851 |                                                                                                                                          |   |   |   |   | KM SD (logged)                                      | 1.211                       |   |   |   |   | 95% Critical H Value (KM-Log)                           | 2.61  |  |
| 4852 |                                                                                                                                          |   |   |   |   | KM Standard Error of Mean (logged)                  | 0.166                       |   |   |   |   |                                                         |       |  |
| 4853 |                                                                                                                                          |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4854 | <b>DL/2 Statistics</b>                                                                                                                   |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4855 | <b>DL/2 Normal</b>                                                                                                                       |   |   |   |   |                                                     | <b>DL/2 Log-Transformed</b> |   |   |   |   |                                                         |       |  |
| 4856 |                                                                                                                                          |   |   |   |   | Mean in Original Scale                              | 42.58                       |   |   |   |   | Mean in Log Scale                                       | 2.849 |  |
| 4857 |                                                                                                                                          |   |   |   |   | SD in Original Scale                                | 115.5                       |   |   |   |   | SD in Log Scale                                         | 1.277 |  |
| 4858 |                                                                                                                                          |   |   |   |   | 95% t UCL (Assumes normality)                       | 68.89                       |   |   |   |   | 95% H-Stat UCL                                          | 62.72 |  |
| 4859 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4860 |                                                                                                                                          |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4861 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4862 | <b>Detected Data appear Approximate Lognormal Distributed at 5% Significance Level</b>                                                   |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4863 |                                                                                                                                          |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4864 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4865 |                                                                                                                                          |   |   |   |   | KM H-UCL                                            | 56.24                       |   |   |   |   |                                                         |       |  |
| 4866 |                                                                                                                                          |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4867 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4868 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4869 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4870 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4871 |                                                                                                                                          |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4872 |                                                                                                                                          |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4873 | <b>Result (eu4_arsenic_waste rock)</b>                                                                                                   |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4874 |                                                                                                                                          |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4875 | <b>General Statistics</b>                                                                                                                |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4876 |                                                                                                                                          |   |   |   |   | Total Number of Observations                        | 15                          |   |   |   |   | Number of Distinct Observations                         | 15    |  |
| 4877 |                                                                                                                                          |   |   |   |   |                                                     |                             |   |   |   |   | Number of Missing Observations                          | 0     |  |
| 4878 |                                                                                                                                          |   |   |   |   | Minimum                                             | 3.7                         |   |   |   |   | Mean                                                    | 1309  |  |
| 4879 |                                                                                                                                          |   |   |   |   | Maximum                                             | 13700                       |   |   |   |   | Median                                                  | 108   |  |
| 4880 |                                                                                                                                          |   |   |   |   | SD                                                  | 3536                        |   |   |   |   | Std. Error of Mean                                      | 913   |  |
| 4881 |                                                                                                                                          |   |   |   |   | Coefficient of Variation                            | 2.701                       |   |   |   |   | Skewness                                                | 3.517 |  |
| 4882 |                                                                                                                                          |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4883 | <b>Normal GOF Test</b>                                                                                                                   |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4884 |                                                                                                                                          |   |   |   |   | Shapiro Wilk Test Statistic                         | 0.417                       |   |   |   |   | <b>Shapiro Wilk GOF Test</b>                            |       |  |
| 4885 |                                                                                                                                          |   |   |   |   | 5% Shapiro Wilk Critical Value                      | 0.881                       |   |   |   |   | Data Not Normal at 5% Significance Level                |       |  |
| 4886 |                                                                                                                                          |   |   |   |   | Lilliefors Test Statistic                           | 0.428                       |   |   |   |   | <b>Lilliefors GOF Test</b>                              |       |  |
| 4887 |                                                                                                                                          |   |   |   |   | 5% Lilliefors Critical Value                        | 0.22                        |   |   |   |   | Data Not Normal at 5% Significance Level                |       |  |
| 4888 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4889 |                                                                                                                                          |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4890 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |   |   |                                                     |                             |   |   |   |   |                                                         |       |  |
| 4891 |                                                                                                                                          |   |   |   |   | <b>95% Normal UCL</b>                               |                             |   |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b>                 |       |  |

| A    | B | C | D                                                                                                                                      | E | F      | G | H | I | J                                                   | K | L      |
|------|---|---|----------------------------------------------------------------------------------------------------------------------------------------|---|--------|---|---|---|-----------------------------------------------------|---|--------|
| 4892 |   |   | 95% Student's-t UCL                                                                                                                    |   | 2917   |   |   |   | 95% Adjusted-CLT UCL (Chen-1995)                    |   | 3697   |
| 4893 |   |   |                                                                                                                                        |   |        |   |   |   | 95% Modified-t UCL (Johnson-1978)                   |   | 3055   |
| 4894 |   |   |                                                                                                                                        |   |        |   |   |   |                                                     |   |        |
| 4895 |   |   | <b>Gamma GOF Test</b>                                                                                                                  |   |        |   |   |   |                                                     |   |        |
| 4896 |   |   | A-D Test Statistic                                                                                                                     |   | 2.015  |   |   |   | <b>Anderson-Darling Gamma GOF Test</b>              |   |        |
| 4897 |   |   | 5% A-D Critical Value                                                                                                                  |   | 0.832  |   |   |   | Data Not Gamma Distributed at 5% Significance Level |   |        |
| 4898 |   |   | K-S Test Statistic                                                                                                                     |   | 0.408  |   |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |        |
| 4899 |   |   | 5% K-S Critical Value                                                                                                                  |   | 0.24   |   |   |   | Data Not Gamma Distributed at 5% Significance Level |   |        |
| 4900 |   |   | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                             |   |        |   |   |   |                                                     |   |        |
| 4901 |   |   |                                                                                                                                        |   |        |   |   |   |                                                     |   |        |
| 4902 |   |   | <b>Gamma Statistics</b>                                                                                                                |   |        |   |   |   |                                                     |   |        |
| 4903 |   |   | k hat (MLE)                                                                                                                            |   | 0.316  |   |   |   | k star (bias corrected MLE)                         |   | 0.298  |
| 4904 |   |   | Theta hat (MLE)                                                                                                                        |   | 4138   |   |   |   | Theta star (bias corrected MLE)                     |   | 4400   |
| 4905 |   |   | nu hat (MLE)                                                                                                                           |   | 9.49   |   |   |   | nu star (bias corrected)                            |   | 8.925  |
| 4906 |   |   | MLE Mean (bias corrected)                                                                                                              |   | 1309   |   |   |   | MLE Sd (bias corrected)                             |   | 2400   |
| 4907 |   |   |                                                                                                                                        |   |        |   |   |   | Approximate Chi Square Value (0.05)                 |   | 3.282  |
| 4908 |   |   | Adjusted Level of Significance                                                                                                         |   | 0.0324 |   |   |   | Adjusted Chi Square Value                           |   | 2.874  |
| 4909 |   |   |                                                                                                                                        |   |        |   |   |   |                                                     |   |        |
| 4910 |   |   | <b>Assuming Gamma Distribution</b>                                                                                                     |   |        |   |   |   |                                                     |   |        |
| 4911 |   |   | 95% Approximate Gamma UCL (use when n>=50))                                                                                            |   | 3560   |   |   |   | 95% Adjusted Gamma UCL (use when n<50)              |   | 4065   |
| 4912 |   |   |                                                                                                                                        |   |        |   |   |   |                                                     |   |        |
| 4913 |   |   | <b>Lognormal GOF Test</b>                                                                                                              |   |        |   |   |   |                                                     |   |        |
| 4914 |   |   | Shapiro Wilk Test Statistic                                                                                                            |   | 0.887  |   |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |        |
| 4915 |   |   | 5% Shapiro Wilk Critical Value                                                                                                         |   | 0.881  |   |   |   | Data appear Lognormal at 5% Significance Level      |   |        |
| 4916 |   |   | Lilliefors Test Statistic                                                                                                              |   | 0.294  |   |   |   | <b>Lilliefors Lognormal GOF Test</b>                |   |        |
| 4917 |   |   | 5% Lilliefors Critical Value                                                                                                           |   | 0.22   |   |   |   | Data Not Lognormal at 5% Significance Level         |   |        |
| 4918 |   |   | <b>Data appear Approximate Lognormal at 5% Significance Level</b>                                                                      |   |        |   |   |   |                                                     |   |        |
| 4919 |   |   |                                                                                                                                        |   |        |   |   |   |                                                     |   |        |
| 4920 |   |   | <b>Lognormal Statistics</b>                                                                                                            |   |        |   |   |   |                                                     |   |        |
| 4921 |   |   | Minimum of Logged Data                                                                                                                 |   | 1.308  |   |   |   | Mean of logged Data                                 |   | 5.016  |
| 4922 |   |   | Maximum of Logged Data                                                                                                                 |   | 9.525  |   |   |   | SD of logged Data                                   |   | 1.994  |
| 4923 |   |   |                                                                                                                                        |   |        |   |   |   |                                                     |   |        |
| 4924 |   |   | <b>Assuming Lognormal Distribution</b>                                                                                                 |   |        |   |   |   |                                                     |   |        |
| 4925 |   |   | 95% H-UCL                                                                                                                              |   | 12466  |   |   |   | 90% Chebyshev (MVUE) UCL                            |   | 2257   |
| 4926 |   |   | 95% Chebyshev (MVUE) UCL                                                                                                               |   | 2911   |   |   |   | 97.5% Chebyshev (MVUE) UCL                          |   | 3819   |
| 4927 |   |   | 99% Chebyshev (MVUE) UCL                                                                                                               |   | 5602   |   |   |   |                                                     |   |        |
| 4928 |   |   |                                                                                                                                        |   |        |   |   |   |                                                     |   |        |
| 4929 |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                  |   |        |   |   |   |                                                     |   |        |
| 4930 |   |   | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                       |   |        |   |   |   |                                                     |   |        |
| 4931 |   |   |                                                                                                                                        |   |        |   |   |   |                                                     |   |        |
| 4932 |   |   | <b>Nonparametric Distribution Free UCLs</b>                                                                                            |   |        |   |   |   |                                                     |   |        |
| 4933 |   |   | 95% CLT UCL                                                                                                                            |   | 2811   |   |   |   | 95% Jackknife UCL                                   |   | 2917   |
| 4934 |   |   | 95% Standard Bootstrap UCL                                                                                                             |   | 2743   |   |   |   | 95% Bootstrap-t UCL                                 |   | 10603  |
| 4935 |   |   | 95% Hall's Bootstrap UCL                                                                                                               |   | 11148  |   |   |   | 95% Percentile Bootstrap UCL                        |   | 3012   |
| 4936 |   |   | 95% BCA Bootstrap UCL                                                                                                                  |   | 3931   |   |   |   |                                                     |   |        |
| 4937 |   |   | 90% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 4048   |   |   |   | 95% Chebyshev(Mean, Sd) UCL                         |   | 5289   |
| 4938 |   |   | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                          |   | 7011   |   |   |   | 99% Chebyshev(Mean, Sd) UCL                         |   | 10393  |
| 4939 |   |   |                                                                                                                                        |   |        |   |   |   |                                                     |   |        |
| 4940 |   |   | <b>Suggested UCL to Use</b>                                                                                                            |   |        |   |   |   |                                                     |   |        |
| 4941 |   |   | 99% Chebyshev (Mean, Sd) UCL                                                                                                           |   | 10393  |   |   |   |                                                     |   |        |
| 4942 |   |   |                                                                                                                                        |   |        |   |   |   |                                                     |   |        |
| 4943 |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.           |   |        |   |   |   |                                                     |   |        |
| 4944 |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                             |   |        |   |   |   |                                                     |   |        |
| 4945 |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).               |   |        |   |   |   |                                                     |   |        |
| 4946 |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistica |   |        |   |   |   |                                                     |   |        |
| 4947 |   |   |                                                                                                                                        |   |        |   |   |   |                                                     |   |        |
| 4948 |   |   | <b>Result (eu4_cadmium_overbank)</b>                                                                                                   |   |        |   |   |   |                                                     |   |        |
| 4949 |   |   |                                                                                                                                        |   |        |   |   |   |                                                     |   |        |
| 4950 |   |   | <b>General Statistics</b>                                                                                                              |   |        |   |   |   |                                                     |   |        |
| 4951 |   |   | Total Number of Observations                                                                                                           |   | 54     |   |   |   | Number of Distinct Observations                     |   | 38     |
| 4952 |   |   | Number of Detects                                                                                                                      |   | 39     |   |   |   | Number of Non-Detects                               |   | 15     |
| 4953 |   |   | Number of Distinct Detects                                                                                                             |   | 30     |   |   |   | Number of Distinct Non-Detects                      |   | 10     |
| 4954 |   |   | Minimum Detect                                                                                                                         |   | 0.059  |   |   |   | Minimum Non-Detect                                  |   | 0.048  |
| 4955 |   |   | Maximum Detect                                                                                                                         |   | 44.3   |   |   |   | Maximum Non-Detect                                  |   | 0.11   |
| 4956 |   |   | Variance Detects                                                                                                                       |   | 48.65  |   |   |   | Percent Non-Detects                                 |   | 27.78% |
| 4957 |   |   | Mean Detects                                                                                                                           |   | 2.256  |   |   |   | SD Detects                                          |   | 6.975  |
| 4958 |   |   | Median Detects                                                                                                                         |   | 1      |   |   |   | CV Detects                                          |   | 3.091  |

| A    | B                                                                                                                         | C | D | E      | F                                                            | G | H | I      | J | K | L |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|--------|--------------------------------------------------------------|---|---|--------|---|---|---|
| 4959 | Skewness Detects                                                                                                          |   |   | 6.066  | Kurtosis Detects                                             |   |   | 37.45  |   |   |   |
| 4960 | Mean of Logged Detects                                                                                                    |   |   | -0.157 | SD of Logged Detects                                         |   |   | 1.186  |   |   |   |
| 4961 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |
| 4962 | <b>Normal GOF Test on Detects Only</b>                                                                                    |   |   |        |                                                              |   |   |        |   |   |   |
| 4963 | Shapiro Wilk Test Statistic                                                                                               |   |   | 0.264  | <b>Shapiro Wilk GOF Test</b>                                 |   |   |        |   |   |   |
| 4964 | 5% Shapiro Wilk Critical Value                                                                                            |   |   | 0.939  | Detected Data Not Normal at 5% Significance Level            |   |   |        |   |   |   |
| 4965 | Lilliefors Test Statistic                                                                                                 |   |   | 0.395  | <b>Lilliefors GOF Test</b>                                   |   |   |        |   |   |   |
| 4966 | 5% Lilliefors Critical Value                                                                                              |   |   | 0.14   | Detected Data Not Normal at 5% Significance Level            |   |   |        |   |   |   |
| 4967 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                  |   |   |        |                                                              |   |   |        |   |   |   |
| 4968 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |
| 4969 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |   |   |        |                                                              |   |   |        |   |   |   |
| 4970 | KM Mean                                                                                                                   |   |   | 1.643  | KM Standard Error of Mean                                    |   |   | 0.818  |   |   |   |
| 4971 | KM SD                                                                                                                     |   |   | 5.934  | 95% KM (BCA) UCL                                             |   |   | 3.245  |   |   |   |
| 4972 | 95% KM (t) UCL                                                                                                            |   |   | 3.012  | 95% KM (Percentile Bootstrap) UCL                            |   |   | 3.243  |   |   |   |
| 4973 | 95% KM (z) UCL                                                                                                            |   |   | 2.989  | 95% KM Bootstrap t UCL                                       |   |   | 8.743  |   |   |   |
| 4974 | 90% KM Chebyshev UCL                                                                                                      |   |   | 4.097  | 95% KM Chebyshev UCL                                         |   |   | 5.209  |   |   |   |
| 4975 | 97.5% KM Chebyshev UCL                                                                                                    |   |   | 6.752  | 99% KM Chebyshev UCL                                         |   |   | 9.782  |   |   |   |
| 4976 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |
| 4977 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |        |                                                              |   |   |        |   |   |   |
| 4978 | A-D Test Statistic                                                                                                        |   |   | 2.844  | <b>Anderson-Darling GOF Test</b>                             |   |   |        |   |   |   |
| 4979 | 5% A-D Critical Value                                                                                                     |   |   | 0.8    | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |        |   |   |   |
| 4980 | K-S Test Statistic                                                                                                        |   |   | 0.228  | <b>Kolmogorov-Smirnov GOF</b>                                |   |   |        |   |   |   |
| 4981 | 5% K-S Critical Value                                                                                                     |   |   | 0.148  | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |        |   |   |   |
| 4982 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                       |   |   |        |                                                              |   |   |        |   |   |   |
| 4983 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |
| 4984 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |        |                                                              |   |   |        |   |   |   |
| 4985 | k hat (MLE)                                                                                                               |   |   | 0.632  | k star (bias corrected MLE)                                  |   |   | 0.6    |   |   |   |
| 4986 | Theta hat (MLE)                                                                                                           |   |   | 3.572  | Theta star (bias corrected MLE)                              |   |   | 3.759  |   |   |   |
| 4987 | nu hat (MLE)                                                                                                              |   |   | 49.27  | nu star (bias corrected)                                     |   |   | 46.81  |   |   |   |
| 4988 | Mean (detects)                                                                                                            |   |   | 2.256  |                                                              |   |   |        |   |   |   |
| 4989 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |
| 4990 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |        |                                                              |   |   |        |   |   |   |
| 4991 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |        |                                                              |   |   |        |   |   |   |
| 4992 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |        |                                                              |   |   |        |   |   |   |
| 4993 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |        |                                                              |   |   |        |   |   |   |
| 4994 | This is especially true when the sample size is small.                                                                    |   |   |        |                                                              |   |   |        |   |   |   |
| 4995 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |        |                                                              |   |   |        |   |   |   |
| 4996 | Minimum                                                                                                                   |   |   | 0.01   | Mean                                                         |   |   | 1.632  |   |   |   |
| 4997 | Maximum                                                                                                                   |   |   | 44.3   | Median                                                       |   |   | 0.59   |   |   |   |
| 4998 | SD                                                                                                                        |   |   | 5.992  | CV                                                           |   |   | 3.671  |   |   |   |
| 4999 | k hat (MLE)                                                                                                               |   |   | 0.356  | k star (bias corrected MLE)                                  |   |   | 0.349  |   |   |   |
| 5000 | Theta hat (MLE)                                                                                                           |   |   | 4.583  | Theta star (bias corrected MLE)                              |   |   | 4.681  |   |   |   |
| 5001 | nu hat (MLE)                                                                                                              |   |   | 38.47  | nu star (bias corrected)                                     |   |   | 37.66  |   |   |   |
| 5002 | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   | 0.0456 |                                                              |   |   |        |   |   |   |
| 5003 | Approximate Chi Square Value (37.66, $\alpha$ )                                                                           |   |   | 24.61  | Adjusted Chi Square Value (37.66, $\beta$ )                  |   |   | 24.32  |   |   |   |
| 5004 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   | 2.498  | 95% Gamma Adjusted UCL (use when $n < 50$ )                  |   |   | 2.528  |   |   |   |
| 5005 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |
| 5006 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |        |                                                              |   |   |        |   |   |   |
| 5007 | Mean (KM)                                                                                                                 |   |   | 1.643  | SD (KM)                                                      |   |   | 5.934  |   |   |   |
| 5008 | Variance (KM)                                                                                                             |   |   | 35.21  | SE of Mean (KM)                                              |   |   | 0.818  |   |   |   |
| 5009 | k hat (KM)                                                                                                                |   |   | 0.0767 | k star (KM)                                                  |   |   | 0.0847 |   |   |   |
| 5010 | nu hat (KM)                                                                                                               |   |   | 8.28   | nu star (KM)                                                 |   |   | 9.153  |   |   |   |
| 5011 | theta hat (KM)                                                                                                            |   |   | 21.43  | theta star (KM)                                              |   |   | 19.39  |   |   |   |
| 5012 | 80% gamma percentile (KM)                                                                                                 |   |   | 0.871  | 90% gamma percentile (KM)                                    |   |   | 4.033  |   |   |   |
| 5013 | 95% gamma percentile (KM)                                                                                                 |   |   | 9.571  | 99% gamma percentile (KM)                                    |   |   | 28.31  |   |   |   |
| 5014 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |
| 5015 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |        |                                                              |   |   |        |   |   |   |
| 5016 | Approximate Chi Square Value (9.15, $\alpha$ )                                                                            |   |   | 3.42   | Adjusted Chi Square Value (9.15, $\beta$ )                   |   |   | 3.324  |   |   |   |
| 5017 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   |   | 4.398  | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )               |   |   | 4.524  |   |   |   |
| 5018 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |
| 5019 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |        |                                                              |   |   |        |   |   |   |
| 5020 | Shapiro Wilk Test Statistic                                                                                               |   |   | 0.956  | <b>Shapiro Wilk GOF Test</b>                                 |   |   |        |   |   |   |
| 5021 | 5% Shapiro Wilk Critical Value                                                                                            |   |   | 0.939  | Detected Data appear Lognormal at 5% Significance Level      |   |   |        |   |   |   |
| 5022 | Lilliefors Test Statistic                                                                                                 |   |   | 0.0994 | <b>Lilliefors GOF Test</b>                                   |   |   |        |   |   |   |
| 5023 | 5% Lilliefors Critical Value                                                                                              |   |   | 0.14   | Detected Data appear Lognormal at 5% Significance Level      |   |   |        |   |   |   |
| 5024 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                            |   |   |        |                                                              |   |   |        |   |   |   |
| 5025 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |

| A    | B                                                                                                                                        | C | D | E      | F                                                            | G | H | I      | J | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|--------------------------------------------------------------|---|---|--------|---|---|---|--|
| 5026 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5027 | Mean in Original Scale                                                                                                                   |   |   | 1.648  | Mean in Log Scale                                            |   |   | -0.875 |   |   |   |  |
| 5028 | SD in Original Scale                                                                                                                     |   |   | 5.988  | SD in Log Scale                                              |   |   | 1.55   |   |   |   |  |
| 5029 | 95% t UCL (assumes normality of ROS data)                                                                                                |   |   | 3.013  | 95% Percentile Bootstrap UCL                                 |   |   | 3.22   |   |   |   |  |
| 5030 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 4.096  | 95% Bootstrap t UCL                                          |   |   | 8.543  |   |   |   |  |
| 5031 | 95% H-UCL (Log ROS)                                                                                                                      |   |   | 2.65   |                                                              |   |   |        |   |   |   |  |
| 5032 |                                                                                                                                          |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5033 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5034 | KM Mean (logged)                                                                                                                         |   |   | -0.956 | KM Geo Mean                                                  |   |   | 0.384  |   |   |   |  |
| 5035 | KM SD (logged)                                                                                                                           |   |   | 1.628  | 95% Critical H Value (KM-Log)                                |   |   | 3.15   |   |   |   |  |
| 5036 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.224  | 95% H-UCL (KM -Log)                                          |   |   | 2.925  |   |   |   |  |
| 5037 | KM SD (logged)                                                                                                                           |   |   | 1.628  | 95% Critical H Value (KM-Log)                                |   |   | 3.15   |   |   |   |  |
| 5038 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.224  |                                                              |   |   |        |   |   |   |  |
| 5039 |                                                                                                                                          |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5040 | <b>DL/2 Statistics</b>                                                                                                                   |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5041 | <b>DL/2 Normal</b>                                                                                                                       |   |   |        | <b>DL/2 Log-Transformed</b>                                  |   |   |        |   |   |   |  |
| 5042 | Mean in Original Scale                                                                                                                   |   |   | 1.638  | Mean in Log Scale                                            |   |   | -1.098 |   |   |   |  |
| 5043 | SD in Original Scale                                                                                                                     |   |   | 5.991  | SD in Log Scale                                              |   |   | 1.836  |   |   |   |  |
| 5044 | 95% t UCL (Assumes normality)                                                                                                            |   |   | 3.003  | 95% H-Stat UCL                                               |   |   | 4.271  |   |   |   |  |
| 5045 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5046 |                                                                                                                                          |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5047 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5048 | <b>Detected Data appear Lognormal Distributed at 5% Significance Level</b>                                                               |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5049 |                                                                                                                                          |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5050 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5051 | KM H-UCL                                                                                                                                 |   |   | 2.925  |                                                              |   |   |        |   |   |   |  |
| 5052 |                                                                                                                                          |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5053 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5054 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5055 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5056 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5057 |                                                                                                                                          |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5058 | <b>Result (eu4_cadmium_waste rock)</b>                                                                                                   |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5059 |                                                                                                                                          |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5060 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5061 | Total Number of Observations                                                                                                             |   |   | 15     | Number of Distinct Observations                              |   |   | 15     |   |   |   |  |
| 5062 | Number of Detects                                                                                                                        |   |   | 14     | Number of Non-Detects                                        |   |   | 1      |   |   |   |  |
| 5063 | Number of Distinct Detects                                                                                                               |   |   | 14     | Number of Distinct Non-Detects                               |   |   | 1      |   |   |   |  |
| 5064 | Minimum Detect                                                                                                                           |   |   | 0.15   | Minimum Non-Detect                                           |   |   | 0.045  |   |   |   |  |
| 5065 | Maximum Detect                                                                                                                           |   |   | 160    | Maximum Non-Detect                                           |   |   | 0.045  |   |   |   |  |
| 5066 | Variance Detects                                                                                                                         |   |   | 3225   | Percent Non-Detects                                          |   |   | 6.667% |   |   |   |  |
| 5067 | Mean Detects                                                                                                                             |   |   | 30.39  | SD Detects                                                   |   |   | 56.79  |   |   |   |  |
| 5068 | Median Detects                                                                                                                           |   |   | 2.9    | CV Detects                                                   |   |   | 1.869  |   |   |   |  |
| 5069 | Skewness Detects                                                                                                                         |   |   | 1.814  | Kurtosis Detects                                             |   |   | 1.85   |   |   |   |  |
| 5070 | Mean of Logged Detects                                                                                                                   |   |   | 1.36   | SD of Logged Detects                                         |   |   | 2.246  |   |   |   |  |
| 5071 |                                                                                                                                          |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5072 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5073 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.582  | <b>Shapiro Wilk GOF Test</b>                                 |   |   |        |   |   |   |  |
| 5074 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.874  | Detected Data Not Normal at 5% Significance Level            |   |   |        |   |   |   |  |
| 5075 | Lilliefors Test Statistic                                                                                                                |   |   | 0.421  | <b>Lilliefors GOF Test</b>                                   |   |   |        |   |   |   |  |
| 5076 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.226  | Detected Data Not Normal at 5% Significance Level            |   |   |        |   |   |   |  |
| 5077 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5078 |                                                                                                                                          |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5079 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5080 | KM Mean                                                                                                                                  |   |   | 28.36  | KM Standard Error of Mean                                    |   |   | 14.31  |   |   |   |  |
| 5081 | KM SD                                                                                                                                    |   |   | 53.41  | 95% KM (BCA) UCL                                             |   |   | 54.05  |   |   |   |  |
| 5082 | 95% KM (t) UCL                                                                                                                           |   |   | 53.57  | 95% KM (Percentile Bootstrap) UCL                            |   |   | 51.74  |   |   |   |  |
| 5083 | 95% KM (z) UCL                                                                                                                           |   |   | 51.9   | 95% KM Bootstrap t UCL                                       |   |   | 80.14  |   |   |   |  |
| 5084 | 90% KM Chebyshev UCL                                                                                                                     |   |   | 71.29  | 95% KM Chebyshev UCL                                         |   |   | 90.74  |   |   |   |  |
| 5085 | 97.5% KM Chebyshev UCL                                                                                                                   |   |   | 117.7  | 99% KM Chebyshev UCL                                         |   |   | 170.7  |   |   |   |  |
| 5086 |                                                                                                                                          |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5087 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |   |   |        |                                                              |   |   |        |   |   |   |  |
| 5088 | A-D Test Statistic                                                                                                                       |   |   | 1.118  | <b>Anderson-Darling GOF Test</b>                             |   |   |        |   |   |   |  |
| 5089 | 5% A-D Critical Value                                                                                                                    |   |   | 0.826  | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |        |   |   |   |  |
| 5090 | K-S Test Statistic                                                                                                                       |   |   | 0.282  | <b>Kolmogorov-Smirnov GOF</b>                                |   |   |        |   |   |   |  |
| 5091 | 5% K-S Critical Value                                                                                                                    |   |   | 0.247  | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |        |   |   |   |  |
| 5092 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                                      |   |   |        |                                                              |   |   |        |   |   |   |  |



| A    | B                                                                                                                                        | C | D         | E | F                                                               | G | H     | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|-----------|---|-----------------------------------------------------------------|---|-------|---|---|---|---|
| 5160 | <b>Suggested UCL to Use</b>                                                                                                              |   |           |   |                                                                 |   |       |   |   |   |   |
| 5161 | 99% KM (Chebyshev) UCL                                                                                                                   |   | 170.7     |   |                                                                 |   |       |   |   |   |   |
| 5162 | <b>Warning: Recommended UCL exceeds the maximum observation</b>                                                                          |   |           |   |                                                                 |   |       |   |   |   |   |
| 5163 |                                                                                                                                          |   |           |   |                                                                 |   |       |   |   |   |   |
| 5164 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |           |   |                                                                 |   |       |   |   |   |   |
| 5165 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |           |   |                                                                 |   |       |   |   |   |   |
| 5166 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |           |   |                                                                 |   |       |   |   |   |   |
| 5167 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |           |   |                                                                 |   |       |   |   |   |   |
| 5168 |                                                                                                                                          |   |           |   |                                                                 |   |       |   |   |   |   |
| 5169 |                                                                                                                                          |   |           |   |                                                                 |   |       |   |   |   |   |
| 5170 | <b>Result (eu4_chromium_overbank)</b>                                                                                                    |   |           |   |                                                                 |   |       |   |   |   |   |
| 5171 |                                                                                                                                          |   |           |   |                                                                 |   |       |   |   |   |   |
| 5172 | <b>General Statistics</b>                                                                                                                |   |           |   |                                                                 |   |       |   |   |   |   |
| 5173 | Total Number of Observations                                                                                                             |   | 54        |   | Number of Distinct Observations                                 |   | 38    |   |   |   |   |
| 5174 |                                                                                                                                          |   |           |   | Number of Missing Observations                                  |   | 0     |   |   |   |   |
| 5175 | Minimum                                                                                                                                  |   | 1.1       |   | Mean                                                            |   | 4.239 |   |   |   |   |
| 5176 | Maximum                                                                                                                                  |   | 12        |   | Median                                                          |   | 4     |   |   |   |   |
| 5177 | SD                                                                                                                                       |   | 2.165     |   | Std. Error of Mean                                              |   | 0.295 |   |   |   |   |
| 5178 | Coefficient of Variation                                                                                                                 |   | 0.511     |   | Skewness                                                        |   | 1.483 |   |   |   |   |
| 5179 |                                                                                                                                          |   |           |   |                                                                 |   |       |   |   |   |   |
| 5180 | <b>Normal GOF Test</b>                                                                                                                   |   |           |   |                                                                 |   |       |   |   |   |   |
| 5181 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.889     |   | <b>Shapiro Wilk GOF Test</b>                                    |   |       |   |   |   |   |
| 5182 | 5% Shapiro Wilk P Value                                                                                                                  |   | 3.3020E-5 |   | Data Not Normal at 5% Significance Level                        |   |       |   |   |   |   |
| 5183 | Lilliefors Test Statistic                                                                                                                |   | 0.175     |   | <b>Lilliefors GOF Test</b>                                      |   |       |   |   |   |   |
| 5184 | 5% Lilliefors Critical Value                                                                                                             |   | 0.12      |   | Data Not Normal at 5% Significance Level                        |   |       |   |   |   |   |
| 5185 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |           |   |                                                                 |   |       |   |   |   |   |
| 5186 |                                                                                                                                          |   |           |   |                                                                 |   |       |   |   |   |   |
| 5187 | <b>Assuming Normal Distribution</b>                                                                                                      |   |           |   |                                                                 |   |       |   |   |   |   |
| 5188 | <b>95% Normal UCL</b>                                                                                                                    |   |           |   | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |       |   |   |   |   |
| 5189 | 95% Student's-t UCL                                                                                                                      |   | 4.732     |   | 95% Adjusted-CLT UCL (Chen-1995)                                |   | 4.787 |   |   |   |   |
| 5190 |                                                                                                                                          |   |           |   | 95% Modified-t UCL (Johnson-1978)                               |   | 4.742 |   |   |   |   |
| 5191 |                                                                                                                                          |   |           |   |                                                                 |   |       |   |   |   |   |
| 5192 | <b>Gamma GOF Test</b>                                                                                                                    |   |           |   |                                                                 |   |       |   |   |   |   |
| 5193 | A-D Test Statistic                                                                                                                       |   | 0.387     |   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |       |   |   |   |   |
| 5194 | 5% A-D Critical Value                                                                                                                    |   | 0.754     |   | Detected data appear Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |
| 5195 | K-S Test Statistic                                                                                                                       |   | 0.112     |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |       |   |   |   |   |
| 5196 | 5% K-S Critical Value                                                                                                                    |   | 0.121     |   | Detected data appear Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |
| 5197 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |           |   |                                                                 |   |       |   |   |   |   |
| 5198 |                                                                                                                                          |   |           |   |                                                                 |   |       |   |   |   |   |
| 5199 | <b>Gamma Statistics</b>                                                                                                                  |   |           |   |                                                                 |   |       |   |   |   |   |
| 5200 | k hat (MLE)                                                                                                                              |   | 4.477     |   | k star (bias corrected MLE)                                     |   | 4.24  |   |   |   |   |
| 5201 | Theta hat (MLE)                                                                                                                          |   | 0.947     |   | Theta star (bias corrected MLE)                                 |   | 1     |   |   |   |   |
| 5202 | nu hat (MLE)                                                                                                                             |   | 483.5     |   | nu star (bias corrected)                                        |   | 458   |   |   |   |   |
| 5203 | MLE Mean (bias corrected)                                                                                                                |   | 4.239     |   | MLE Sd (bias corrected)                                         |   | 2.059 |   |   |   |   |
| 5204 |                                                                                                                                          |   |           |   | Approximate Chi Square Value (0.05)                             |   | 409.3 |   |   |   |   |
| 5205 | Adjusted Level of Significance                                                                                                           |   | 0.0456    |   | Adjusted Chi Square Value                                       |   | 408.1 |   |   |   |   |
| 5206 |                                                                                                                                          |   |           |   |                                                                 |   |       |   |   |   |   |
| 5207 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |           |   |                                                                 |   |       |   |   |   |   |
| 5208 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   | 4.743     |   | 95% Adjusted Gamma UCL (use when n<50)                          |   | 4.757 |   |   |   |   |
| 5209 |                                                                                                                                          |   |           |   |                                                                 |   |       |   |   |   |   |
| 5210 | <b>Lognormal GOF Test</b>                                                                                                                |   |           |   |                                                                 |   |       |   |   |   |   |
| 5211 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.987     |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |       |   |   |   |   |
| 5212 | 5% Shapiro Wilk P Value                                                                                                                  |   | 0.931     |   | Data appear Lognormal at 5% Significance Level                  |   |       |   |   |   |   |
| 5213 | Lilliefors Test Statistic                                                                                                                |   | 0.0859    |   | <b>Lilliefors Lognormal GOF Test</b>                            |   |       |   |   |   |   |
| 5214 | 5% Lilliefors Critical Value                                                                                                             |   | 0.12      |   | Data appear Lognormal at 5% Significance Level                  |   |       |   |   |   |   |
| 5215 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |           |   |                                                                 |   |       |   |   |   |   |
| 5216 |                                                                                                                                          |   |           |   |                                                                 |   |       |   |   |   |   |
| 5217 | <b>Lognormal Statistics</b>                                                                                                              |   |           |   |                                                                 |   |       |   |   |   |   |
| 5218 | Minimum of Logged Data                                                                                                                   |   | 0.0953    |   | Mean of logged Data                                             |   | 1.329 |   |   |   |   |
| 5219 | Maximum of Logged Data                                                                                                                   |   | 2.485     |   | SD of logged Data                                               |   | 0.488 |   |   |   |   |
| 5220 |                                                                                                                                          |   |           |   |                                                                 |   |       |   |   |   |   |
| 5221 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |           |   |                                                                 |   |       |   |   |   |   |
| 5222 | 95% H-UCL                                                                                                                                |   | 4.821     |   | 90% Chebyshev (MVUE) UCL                                        |   | 5.127 |   |   |   |   |
| 5223 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 5.528     |   | 97.5% Chebyshev (MVUE) UCL                                      |   | 6.085 |   |   |   |   |
| 5224 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 7.179     |   |                                                                 |   |       |   |   |   |   |
| 5225 |                                                                                                                                          |   |           |   |                                                                 |   |       |   |   |   |   |
| 5226 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |           |   |                                                                 |   |       |   |   |   |   |

| A    | B                                                                                                                                        | C      | D | E | F | G                                       | H | I                                                               | J     | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------|---|---|---|-----------------------------------------|---|-----------------------------------------------------------------|-------|---|---|--|
| 5227 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5228 |                                                                                                                                          |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5229 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5230 | 95% CLT UCL                                                                                                                              | 4.724  |   |   |   |                                         |   | 95% Jackknife UCL                                               | 4.732 |   |   |  |
| 5231 | 95% Standard Bootstrap UCL                                                                                                               | 4.719  |   |   |   |                                         |   | 95% Bootstrap-t UCL                                             | 4.828 |   |   |  |
| 5232 | 95% Hall's Bootstrap UCL                                                                                                                 | 4.799  |   |   |   |                                         |   | 95% Percentile Bootstrap UCL                                    | 4.731 |   |   |  |
| 5233 | 95% BCA Bootstrap UCL                                                                                                                    | 4.781  |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5234 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              | 5.123  |   |   |   |                                         |   | 95% Chebyshev(Mean, Sd) UCL                                     | 5.523 |   |   |  |
| 5235 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            | 6.079  |   |   |   |                                         |   | 99% Chebyshev(Mean, Sd) UCL                                     | 7.17  |   |   |  |
| 5236 |                                                                                                                                          |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5237 | <b>Suggested UCL to Use</b>                                                                                                              |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5238 | 95% Approximate Gamma UCL                                                                                                                | 4.743  |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5239 |                                                                                                                                          |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5240 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5241 | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5242 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5243 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5244 |                                                                                                                                          |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5245 |                                                                                                                                          |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5246 | <b>Result (eu4_chromium_waste rock)</b>                                                                                                  |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5247 |                                                                                                                                          |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5248 | <b>General Statistics</b>                                                                                                                |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5249 | Total Number of Observations                                                                                                             | 15     |   |   |   |                                         |   | Number of Distinct Observations                                 | 14    |   |   |  |
| 5250 |                                                                                                                                          |        |   |   |   |                                         |   | Number of Missing Observations                                  | 0     |   |   |  |
| 5251 | Minimum                                                                                                                                  | 1.2    |   |   |   |                                         |   | Mean                                                            | 5.24  |   |   |  |
| 5252 | Maximum                                                                                                                                  | 16.5   |   |   |   |                                         |   | Median                                                          | 3.9   |   |   |  |
| 5253 | SD                                                                                                                                       | 3.796  |   |   |   |                                         |   | Std. Error of Mean                                              | 0.98  |   |   |  |
| 5254 | Coefficient of Variation                                                                                                                 | 0.724  |   |   |   |                                         |   | Skewness                                                        | 2.093 |   |   |  |
| 5255 |                                                                                                                                          |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5256 | <b>Normal GOF Test</b>                                                                                                                   |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5257 | Shapiro Wilk Test Statistic                                                                                                              | 0.794  |   |   |   |                                         |   | <b>Shapiro Wilk GOF Test</b>                                    |       |   |   |  |
| 5258 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.881  |   |   |   |                                         |   | Data Not Normal at 5% Significance Level                        |       |   |   |  |
| 5259 | Lilliefors Test Statistic                                                                                                                | 0.227  |   |   |   |                                         |   | <b>Lilliefors GOF Test</b>                                      |       |   |   |  |
| 5260 | 5% Lilliefors Critical Value                                                                                                             | 0.22   |   |   |   |                                         |   | Data Not Normal at 5% Significance Level                        |       |   |   |  |
| 5261 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5262 |                                                                                                                                          |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5263 | <b>Assuming Normal Distribution</b>                                                                                                      |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5264 | <b>95% Normal UCL</b>                                                                                                                    |        |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |                                                                 |       |   |   |  |
| 5265 | 95% Student's-t UCL                                                                                                                      | 6.966  |   |   |   |                                         |   | 95% Adjusted-CLT UCL (Chen-1995)                                | 7.418 |   |   |  |
| 5266 |                                                                                                                                          |        |   |   |   |                                         |   | 95% Modified-t UCL (Johnson-1978)                               | 7.055 |   |   |  |
| 5267 |                                                                                                                                          |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5268 | <b>Gamma GOF Test</b>                                                                                                                    |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5269 | A-D Test Statistic                                                                                                                       | 0.336  |   |   |   |                                         |   | <b>Anderson-Darling Gamma GOF Test</b>                          |       |   |   |  |
| 5270 | 5% A-D Critical Value                                                                                                                    | 0.745  |   |   |   |                                         |   | detected data appear Gamma Distributed at 5% Significance Level |       |   |   |  |
| 5271 | K-S Test Statistic                                                                                                                       | 0.145  |   |   |   |                                         |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |       |   |   |  |
| 5272 | 5% K-S Critical Value                                                                                                                    | 0.224  |   |   |   |                                         |   | detected data appear Gamma Distributed at 5% Significance Level |       |   |   |  |
| 5273 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5274 |                                                                                                                                          |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5275 | <b>Gamma Statistics</b>                                                                                                                  |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5276 | k hat (MLE)                                                                                                                              | 2.711  |   |   |   |                                         |   | k star (bias corrected MLE)                                     | 2.213 |   |   |  |
| 5277 | Theta hat (MLE)                                                                                                                          | 1.933  |   |   |   |                                         |   | Theta star (bias corrected MLE)                                 | 2.368 |   |   |  |
| 5278 | nu hat (MLE)                                                                                                                             | 81.32  |   |   |   |                                         |   | nu star (bias corrected)                                        | 66.39 |   |   |  |
| 5279 | MLE Mean (bias corrected)                                                                                                                | 5.24   |   |   |   |                                         |   | MLE Sd (bias corrected)                                         | 3.522 |   |   |  |
| 5280 |                                                                                                                                          |        |   |   |   |                                         |   | Approximate Chi Square Value (0.05)                             | 48.64 |   |   |  |
| 5281 | Adjusted Level of Significance                                                                                                           | 0.0324 |   |   |   |                                         |   | Adjusted Chi Square Value                                       | 46.77 |   |   |  |
| 5282 |                                                                                                                                          |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5283 | <b>Assuming Gamma Distribution</b>                                                                                                       |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5284 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               | 7.152  |   |   |   |                                         |   | 95% Adjusted Gamma UCL (use when n<50)                          | 7.438 |   |   |  |
| 5285 |                                                                                                                                          |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5286 | <b>Lognormal GOF Test</b>                                                                                                                |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5287 | Shapiro Wilk Test Statistic                                                                                                              | 0.983  |   |   |   |                                         |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |       |   |   |  |
| 5288 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.881  |   |   |   |                                         |   | Data appear Lognormal at 5% Significance Level                  |       |   |   |  |
| 5289 | Lilliefors Test Statistic                                                                                                                | 0.106  |   |   |   |                                         |   | <b>Lilliefors Lognormal GOF Test</b>                            |       |   |   |  |
| 5290 | 5% Lilliefors Critical Value                                                                                                             | 0.22   |   |   |   |                                         |   | Data appear Lognormal at 5% Significance Level                  |       |   |   |  |
| 5291 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5292 |                                                                                                                                          |        |   |   |   |                                         |   |                                                                 |       |   |   |  |
| 5293 | <b>Lognormal Statistics</b>                                                                                                              |        |   |   |   |                                         |   |                                                                 |       |   |   |  |

| A    | B                                                                                                                                        | C | D                                          | E | F     | G | H | I | J                                                   | K | L     |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|--------------------------------------------|---|-------|---|---|---|-----------------------------------------------------|---|-------|
| 5294 |                                                                                                                                          |   | Minimum of Logged Data                     |   | 0.182 |   |   |   | Mean of logged Data                                 |   | 1.461 |
| 5295 |                                                                                                                                          |   | Maximum of Logged Data                     |   | 2.803 |   |   |   | SD of logged Data                                   |   | 0.639 |
| 5296 |                                                                                                                                          |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5297 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5298 |                                                                                                                                          |   | 95% H-UCL                                  |   | 7.731 |   |   |   | 90% Chebyshev (MVUE) UCL                            |   | 7.895 |
| 5299 |                                                                                                                                          |   | 95% Chebyshev (MVUE) UCL                   |   | 9.115 |   |   |   | 97.5% Chebyshev (MVUE) UCL                          |   | 10.81 |
| 5300 |                                                                                                                                          |   | 99% Chebyshev (MVUE) UCL                   |   | 14.13 |   |   |   |                                                     |   |       |
| 5301 |                                                                                                                                          |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5302 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5303 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5304 |                                                                                                                                          |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5305 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5306 |                                                                                                                                          |   | 95% CLT UCL                                |   | 6.852 |   |   |   | 95% Jackknife UCL                                   |   | 6.966 |
| 5307 |                                                                                                                                          |   | 95% Standard Bootstrap UCL                 |   | 6.793 |   |   |   | 95% Bootstrap-t UCL                                 |   | 8.424 |
| 5308 |                                                                                                                                          |   | 95% Hall's Bootstrap UCL                   |   | 15.23 |   |   |   | 95% Percentile Bootstrap UCL                        |   | 6.793 |
| 5309 |                                                                                                                                          |   | 95% BCA Bootstrap UCL                      |   | 7.46  |   |   |   |                                                     |   |       |
| 5310 |                                                                                                                                          |   | 90% Chebyshev(Mean, Sd) UCL                |   | 8.181 |   |   |   | 95% Chebyshev(Mean, Sd) UCL                         |   | 9.512 |
| 5311 |                                                                                                                                          |   | 97.5% Chebyshev(Mean, Sd) UCL              |   | 11.36 |   |   |   | 99% Chebyshev(Mean, Sd) UCL                         |   | 14.99 |
| 5312 |                                                                                                                                          |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5313 | <b>Suggested UCL to Use</b>                                                                                                              |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5314 |                                                                                                                                          |   | 95% Adjusted Gamma UCL                     |   | 7.438 |   |   |   |                                                     |   |       |
| 5315 |                                                                                                                                          |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5316 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5317 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5318 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5319 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5320 |                                                                                                                                          |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5321 |                                                                                                                                          |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5322 | <b>Result (eu4_cobalt_overbank)</b>                                                                                                      |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5323 |                                                                                                                                          |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5324 | <b>General Statistics</b>                                                                                                                |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5325 |                                                                                                                                          |   | Total Number of Observations               |   | 48    |   |   |   | Number of Distinct Observations                     |   | 45    |
| 5326 |                                                                                                                                          |   |                                            |   |       |   |   |   | Number of Missing Observations                      |   | 0     |
| 5327 |                                                                                                                                          |   | Minimum                                    |   | 0.71  |   |   |   | Mean                                                |   | 11.96 |
| 5328 |                                                                                                                                          |   | Maximum                                    |   | 69.8  |   |   |   | Median                                              |   | 9.15  |
| 5329 |                                                                                                                                          |   | SD                                         |   | 13.14 |   |   |   | Std. Error of Mean                                  |   | 1.896 |
| 5330 |                                                                                                                                          |   | Coefficient of Variation                   |   | 1.099 |   |   |   | Skewness                                            |   | 2.765 |
| 5331 |                                                                                                                                          |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5332 | <b>Normal GOF Test</b>                                                                                                                   |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5333 |                                                                                                                                          |   | Shapiro Wilk Test Statistic                |   | 0.667 |   |   |   | <b>Shapiro Wilk GOF Test</b>                        |   |       |
| 5334 |                                                                                                                                          |   | 5% Shapiro Wilk Critical Value             |   | 0.947 |   |   |   | Data Not Normal at 5% Significance Level            |   |       |
| 5335 |                                                                                                                                          |   | Lilliefors Test Statistic                  |   | 0.275 |   |   |   | <b>Lilliefors GOF Test</b>                          |   |       |
| 5336 |                                                                                                                                          |   | 5% Lilliefors Critical Value               |   | 0.127 |   |   |   | Data Not Normal at 5% Significance Level            |   |       |
| 5337 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5338 |                                                                                                                                          |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5339 | <b>Assuming Normal Distribution</b>                                                                                                      |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5340 |                                                                                                                                          |   | <b>95% Normal UCL</b>                      |   |       |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b>             |   |       |
| 5341 |                                                                                                                                          |   | 95% Student's-t UCL                        |   | 15.14 |   |   |   | 95% Adjusted-CLT UCL (Chen-1995)                    |   | 15.89 |
| 5342 |                                                                                                                                          |   |                                            |   |       |   |   |   | 95% Modified-t UCL (Johnson-1978)                   |   | 15.27 |
| 5343 |                                                                                                                                          |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5344 | <b>Gamma GOF Test</b>                                                                                                                    |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5345 |                                                                                                                                          |   | A-D Test Statistic                         |   | 1.384 |   |   |   | <b>Anderson-Darling Gamma GOF Test</b>              |   |       |
| 5346 |                                                                                                                                          |   | 5% A-D Critical Value                      |   | 0.769 |   |   |   | Data Not Gamma Distributed at 5% Significance Level |   |       |
| 5347 |                                                                                                                                          |   | K-S Test Statistic                         |   | 0.161 |   |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |       |
| 5348 |                                                                                                                                          |   | 5% K-S Critical Value                      |   | 0.13  |   |   |   | Data Not Gamma Distributed at 5% Significance Level |   |       |
| 5349 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5350 |                                                                                                                                          |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5351 | <b>Gamma Statistics</b>                                                                                                                  |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5352 |                                                                                                                                          |   | k hat (MLE)                                |   | 1.432 |   |   |   | k star (bias corrected MLE)                         |   | 1.356 |
| 5353 |                                                                                                                                          |   | Theta hat (MLE)                            |   | 8.352 |   |   |   | Theta star (bias corrected MLE)                     |   | 8.817 |
| 5354 |                                                                                                                                          |   | nu hat (MLE)                               |   | 137.5 |   |   |   | nu star (bias corrected)                            |   | 130.2 |
| 5355 |                                                                                                                                          |   | MLE Mean (bias corrected)                  |   | 11.96 |   |   |   | MLE Sd (bias corrected)                             |   | 10.27 |
| 5356 |                                                                                                                                          |   |                                            |   |       |   |   |   | Approximate Chi Square Value (0.05)                 |   | 104.9 |
| 5357 |                                                                                                                                          |   | Adjusted Level of Significance             |   | 0.045 |   |   |   | Adjusted Chi Square Value                           |   | 104.2 |
| 5358 |                                                                                                                                          |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5359 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |                                            |   |       |   |   |   |                                                     |   |       |
| 5360 |                                                                                                                                          |   | 95% Approximate Gamma UCL (use when n>=50) |   | 14.85 |   |   |   | 95% Adjusted Gamma UCL (use when n<50)              |   | 14.95 |

|      | A                                                                                                                                        | B | C      | D                                                   | E | F | G | H                                 | I | J     | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|-----------------------------------------------------|---|---|---|-----------------------------------|---|-------|---|---|
| 5361 |                                                                                                                                          |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5362 | <b>Lognormal GOF Test</b>                                                                                                                |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5363 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.977  | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |   |   |                                   |   |       |   |   |
| 5364 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.947  | Data appear Lognormal at 5% Significance Level      |   |   |   |                                   |   |       |   |   |
| 5365 | Lilliefors Test Statistic                                                                                                                |   | 0.101  | <b>Lilliefors Lognormal GOF Test</b>                |   |   |   |                                   |   |       |   |   |
| 5366 | 5% Lilliefors Critical Value                                                                                                             |   | 0.127  | Data appear Lognormal at 5% Significance Level      |   |   |   |                                   |   |       |   |   |
| 5367 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5368 |                                                                                                                                          |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5369 | <b>Lognormal Statistics</b>                                                                                                              |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5370 | Minimum of Logged Data                                                                                                                   |   | -0.342 |                                                     |   |   |   | Mean of logged Data               |   | 2.094 |   |   |
| 5371 | Maximum of Logged Data                                                                                                                   |   | 4.246  |                                                     |   |   |   | SD of logged Data                 |   | 0.869 |   |   |
| 5372 |                                                                                                                                          |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5373 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5374 | 95% H-UCL                                                                                                                                |   | 15.65  |                                                     |   |   |   | 90% Chebyshev (MVUE) UCL          |   | 16.73 |   |   |
| 5375 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 19     |                                                     |   |   |   | 97.5% Chebyshev (MVUE) UCL        |   | 22.15 |   |   |
| 5376 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 28.35  |                                                     |   |   |   |                                   |   |       |   |   |
| 5377 |                                                                                                                                          |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5378 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5379 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5380 |                                                                                                                                          |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5381 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5382 | 95% CLT UCL                                                                                                                              |   | 15.08  |                                                     |   |   |   | 95% Jackknife UCL                 |   | 15.14 |   |   |
| 5383 | 95% Standard Bootstrap UCL                                                                                                               |   | 15.02  |                                                     |   |   |   | 95% Bootstrap-t UCL               |   | 16.55 |   |   |
| 5384 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 16.65  |                                                     |   |   |   | 95% Percentile Bootstrap UCL      |   | 15.28 |   |   |
| 5385 | 95% BCA Bootstrap UCL                                                                                                                    |   | 16.14  |                                                     |   |   |   |                                   |   |       |   |   |
| 5386 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 17.65  |                                                     |   |   |   | 95% Chebyshev(Mean, Sd) UCL       |   | 20.23 |   |   |
| 5387 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 23.8   |                                                     |   |   |   | 99% Chebyshev(Mean, Sd) UCL       |   | 30.83 |   |   |
| 5388 |                                                                                                                                          |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5389 | <b>Suggested UCL to Use</b>                                                                                                              |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5390 | 95% H-UCL                                                                                                                                |   | 15.65  |                                                     |   |   |   |                                   |   |       |   |   |
| 5391 |                                                                                                                                          |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5392 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5393 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5394 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5395 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5396 |                                                                                                                                          |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5397 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5398 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5399 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5400 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5401 |                                                                                                                                          |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5402 |                                                                                                                                          |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5403 | <b>Result (eu4_cobalt_waste rock)</b>                                                                                                    |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5404 |                                                                                                                                          |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5405 | <b>General Statistics</b>                                                                                                                |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5406 | Total Number of Observations                                                                                                             |   | 15     |                                                     |   |   |   | Number of Distinct Observations   |   | 15    |   |   |
| 5407 |                                                                                                                                          |   |        |                                                     |   |   |   | Number of Missing Observations    |   | 0     |   |   |
| 5408 | Minimum                                                                                                                                  |   | 0.71   |                                                     |   |   |   | Mean                              |   | 13.24 |   |   |
| 5409 | Maximum                                                                                                                                  |   | 117    |                                                     |   |   |   | Median                            |   | 4.9   |   |   |
| 5410 | SD                                                                                                                                       |   | 29.07  |                                                     |   |   |   | Std. Error of Mean                |   | 7.505 |   |   |
| 5411 | Coefficient of Variation                                                                                                                 |   | 2.195  |                                                     |   |   |   | Skewness                          |   | 3.717 |   |   |
| 5412 |                                                                                                                                          |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5413 | <b>Normal GOF Test</b>                                                                                                                   |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5414 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.401  | <b>Shapiro Wilk GOF Test</b>                        |   |   |   |                                   |   |       |   |   |
| 5415 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.881  | Data Not Normal at 5% Significance Level            |   |   |   |                                   |   |       |   |   |
| 5416 | Lilliefors Test Statistic                                                                                                                |   | 0.426  | <b>Lilliefors GOF Test</b>                          |   |   |   |                                   |   |       |   |   |
| 5417 | 5% Lilliefors Critical Value                                                                                                             |   | 0.22   | Data Not Normal at 5% Significance Level            |   |   |   |                                   |   |       |   |   |
| 5418 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5419 |                                                                                                                                          |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5420 | <b>Assuming Normal Distribution</b>                                                                                                      |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5421 | <b>95% Normal UCL</b>                                                                                                                    |   |        | <b>95% UCLs (Adjusted for Skewness)</b>             |   |   |   |                                   |   |       |   |   |
| 5422 | 95% Student's-t UCL                                                                                                                      |   | 26.46  |                                                     |   |   |   | 95% Adjusted-CLT UCL (Chen-1995)  |   | 33.28 |   |   |
| 5423 |                                                                                                                                          |   |        |                                                     |   |   |   | 95% Modified-t UCL (Johnson-1978) |   | 27.66 |   |   |
| 5424 |                                                                                                                                          |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5425 | <b>Gamma GOF Test</b>                                                                                                                    |   |        |                                                     |   |   |   |                                   |   |       |   |   |
| 5426 | A-D Test Statistic                                                                                                                       |   | 1.878  | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |   |                                   |   |       |   |   |
| 5427 | 5% A-D Critical Value                                                                                                                    |   | 0.779  | Data Not Gamma Distributed at 5% Significance Level |   |   |   |                                   |   |       |   |   |

| A    | B                                                                                                                                        | C | D | E         | F                                                   | G | H | I     | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|-----------|-----------------------------------------------------|---|---|-------|---|---|---|
| 5428 | K-S Test Statistic                                                                                                                       |   |   | 0.327     | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |       |   |   |   |
| 5429 | 5% K-S Critical Value                                                                                                                    |   |   | 0.231     | Data Not Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |
| 5430 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |   |           |                                                     |   |   |       |   |   |   |
| 5431 |                                                                                                                                          |   |   |           |                                                     |   |   |       |   |   |   |
| 5432 | <b>Gamma Statistics</b>                                                                                                                  |   |   |           |                                                     |   |   |       |   |   |   |
| 5433 | k hat (MLE)                                                                                                                              |   |   | 0.702     | k star (bias corrected MLE)                         |   |   | 0.606 |   |   |   |
| 5434 | Theta hat (MLE)                                                                                                                          |   |   | 18.87     | Theta star (bias corrected MLE)                     |   |   | 21.86 |   |   |   |
| 5435 | nu hat (MLE)                                                                                                                             |   |   | 21.05     | nu star (bias corrected)                            |   |   | 18.17 |   |   |   |
| 5436 | MLE Mean (bias corrected)                                                                                                                |   |   | 13.24     | MLE Sd (bias corrected)                             |   |   | 17.01 |   |   |   |
| 5437 |                                                                                                                                          |   |   |           | Approximate Chi Square Value (0.05)                 |   |   | 9.515 |   |   |   |
| 5438 | Adjusted Level of Significance                                                                                                           |   |   | 0.0324    | Adjusted Chi Square Value                           |   |   | 8.752 |   |   |   |
| 5439 |                                                                                                                                          |   |   |           |                                                     |   |   |       |   |   |   |
| 5440 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |           |                                                     |   |   |       |   |   |   |
| 5441 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |   | 25.29     | 95% Adjusted Gamma UCL (use when n<50)              |   |   | 27.49 |   |   |   |
| 5442 |                                                                                                                                          |   |   |           |                                                     |   |   |       |   |   |   |
| 5443 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |           |                                                     |   |   |       |   |   |   |
| 5444 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.883     | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |   |       |   |   |   |
| 5445 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.881     | Data appear Lognormal at 5% Significance Level      |   |   |       |   |   |   |
| 5446 | Lilliefors Test Statistic                                                                                                                |   |   | 0.207     | <b>Lilliefors Lognormal GOF Test</b>                |   |   |       |   |   |   |
| 5447 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.22      | Data appear Lognormal at 5% Significance Level      |   |   |       |   |   |   |
| 5448 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |           |                                                     |   |   |       |   |   |   |
| 5449 |                                                                                                                                          |   |   |           |                                                     |   |   |       |   |   |   |
| 5450 | <b>Lognormal Statistics</b>                                                                                                              |   |   |           |                                                     |   |   |       |   |   |   |
| 5451 | Minimum of Logged Data                                                                                                                   |   |   | -0.342    | Mean of logged Data                                 |   |   | 1.722 |   |   |   |
| 5452 | Maximum of Logged Data                                                                                                                   |   |   | 4.762     | SD of logged Data                                   |   |   | 1.127 |   |   |   |
| 5453 |                                                                                                                                          |   |   |           |                                                     |   |   |       |   |   |   |
| 5454 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |           |                                                     |   |   |       |   |   |   |
| 5455 | 95% H-UCL                                                                                                                                |   |   | 25.69     | 90% Chebyshev (MVUE) UCL                            |   |   | 19.51 |   |   |   |
| 5456 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 23.86     | 97.5% Chebyshev (MVUE) UCL                          |   |   | 29.89 |   |   |   |
| 5457 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 41.74     |                                                     |   |   |       |   |   |   |
| 5458 |                                                                                                                                          |   |   |           |                                                     |   |   |       |   |   |   |
| 5459 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |           |                                                     |   |   |       |   |   |   |
| 5460 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |           |                                                     |   |   |       |   |   |   |
| 5461 |                                                                                                                                          |   |   |           |                                                     |   |   |       |   |   |   |
| 5462 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |           |                                                     |   |   |       |   |   |   |
| 5463 | 95% CLT UCL                                                                                                                              |   |   | 25.59     | 95% Jackknife UCL                                   |   |   | 26.46 |   |   |   |
| 5464 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 24.95     | 95% Bootstrap-t UCL                                 |   |   | 133.2 |   |   |   |
| 5465 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 89.12     | 95% Percentile Bootstrap UCL                        |   |   | 27.7  |   |   |   |
| 5466 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 36        |                                                     |   |   |       |   |   |   |
| 5467 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 35.76     | 95% Chebyshev(Mean, Sd) UCL                         |   |   | 45.95 |   |   |   |
| 5468 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 60.11     | 99% Chebyshev(Mean, Sd) UCL                         |   |   | 87.92 |   |   |   |
| 5469 |                                                                                                                                          |   |   |           |                                                     |   |   |       |   |   |   |
| 5470 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |           |                                                     |   |   |       |   |   |   |
| 5471 | 95% Chebyshev (Mean, Sd) UCL                                                                                                             |   |   | 45.95     |                                                     |   |   |       |   |   |   |
| 5472 |                                                                                                                                          |   |   |           |                                                     |   |   |       |   |   |   |
| 5473 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |           |                                                     |   |   |       |   |   |   |
| 5474 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |           |                                                     |   |   |       |   |   |   |
| 5475 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |           |                                                     |   |   |       |   |   |   |
| 5476 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |           |                                                     |   |   |       |   |   |   |
| 5477 |                                                                                                                                          |   |   |           |                                                     |   |   |       |   |   |   |
| 5478 |                                                                                                                                          |   |   |           |                                                     |   |   |       |   |   |   |
| 5479 | <b>Result (eu4_iron_overbank)</b>                                                                                                        |   |   |           |                                                     |   |   |       |   |   |   |
| 5480 |                                                                                                                                          |   |   |           |                                                     |   |   |       |   |   |   |
| 5481 | <b>General Statistics</b>                                                                                                                |   |   |           |                                                     |   |   |       |   |   |   |
| 5482 | Total Number of Observations                                                                                                             |   |   | 54        | Number of Distinct Observations                     |   |   | 54    |   |   |   |
| 5483 |                                                                                                                                          |   |   |           | Number of Missing Observations                      |   |   | 0     |   |   |   |
| 5484 | Minimum                                                                                                                                  |   |   | 12100     | Mean                                                |   |   | 54226 |   |   |   |
| 5485 | Maximum                                                                                                                                  |   |   | 317000    | Median                                              |   |   | 41850 |   |   |   |
| 5486 | SD                                                                                                                                       |   |   | 46689     | Std. Error of Mean                                  |   |   | 6354  |   |   |   |
| 5487 | Coefficient of Variation                                                                                                                 |   |   | 0.861     | Skewness                                            |   |   | 3.866 |   |   |   |
| 5488 |                                                                                                                                          |   |   |           |                                                     |   |   |       |   |   |   |
| 5489 | <b>Normal GOF Test</b>                                                                                                                   |   |   |           |                                                     |   |   |       |   |   |   |
| 5490 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.626     | <b>Shapiro Wilk GOF Test</b>                        |   |   |       |   |   |   |
| 5491 | 5% Shapiro Wilk P Value                                                                                                                  |   |   | 1.110E-16 | Data Not Normal at 5% Significance Level            |   |   |       |   |   |   |
| 5492 | Lilliefors Test Statistic                                                                                                                |   |   | 0.252     | <b>Lilliefors GOF Test</b>                          |   |   |       |   |   |   |
| 5493 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.12      | Data Not Normal at 5% Significance Level            |   |   |       |   |   |   |
| 5494 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |           |                                                     |   |   |       |   |   |   |

| A    | B                                                                                                                                        | C | D      | E     | F                                   | G                                                   | H | I | J      | K     | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|-------|-------------------------------------|-----------------------------------------------------|---|---|--------|-------|---|--|
| 5495 |                                                                                                                                          |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5496 | <b>Assuming Normal Distribution</b>                                                                                                      |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5497 | <b>95% Normal UCL</b>                                                                                                                    |   |        |       |                                     | <b>95% UCLs (Adjusted for Skewness)</b>             |   |   |        |       |   |  |
| 5498 | 95% Student's-t UCL                                                                                                                      |   |        | 64862 |                                     | 95% Adjusted-CLT UCL (Chen-1995)                    |   |   |        | 68248 |   |  |
| 5499 |                                                                                                                                          |   |        |       |                                     | 95% Modified-t UCL (Johnson-1978)                   |   |   |        | 65420 |   |  |
| 5500 |                                                                                                                                          |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5501 | <b>Gamma GOF Test</b>                                                                                                                    |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5502 | A-D Test Statistic                                                                                                                       |   |        | 1.92  |                                     | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |        |       |   |  |
| 5503 | 5% A-D Critical Value                                                                                                                    |   |        | 0.759 |                                     | Data Not Gamma Distributed at 5% Significance Level |   |   |        |       |   |  |
| 5504 | K-S Test Statistic                                                                                                                       |   |        | 0.167 |                                     | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |        |       |   |  |
| 5505 | 5% K-S Critical Value                                                                                                                    |   |        | 0.122 |                                     | Data Not Gamma Distributed at 5% Significance Level |   |   |        |       |   |  |
| 5506 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5507 |                                                                                                                                          |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5508 | <b>Gamma Statistics</b>                                                                                                                  |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5509 | k hat (MLE)                                                                                                                              |   | 2.694  |       | k star (bias corrected MLE)         |                                                     |   |   | 2.556  |       |   |  |
| 5510 | Theta hat (MLE)                                                                                                                          |   | 20131  |       | Theta star (bias corrected MLE)     |                                                     |   |   | 21212  |       |   |  |
| 5511 | nu hat (MLE)                                                                                                                             |   | 290.9  |       | nu star (bias corrected)            |                                                     |   |   | 276.1  |       |   |  |
| 5512 | MLE Mean (bias corrected)                                                                                                                |   | 54226  |       | MLE Sd (bias corrected)             |                                                     |   |   | 33915  |       |   |  |
| 5513 |                                                                                                                                          |   |        |       | Approximate Chi Square Value (0.05) |                                                     |   |   | 238.6  |       |   |  |
| 5514 | Adjusted Level of Significance                                                                                                           |   | 0.0456 |       | Adjusted Chi Square Value           |                                                     |   |   | 237.7  |       |   |  |
| 5515 |                                                                                                                                          |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5516 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5517 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |        | 62744 |                                     | 95% Adjusted Gamma UCL (use when n<50)              |   |   |        | 62995 |   |  |
| 5518 |                                                                                                                                          |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5519 | <b>Lognormal GOF Test</b>                                                                                                                |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5520 | Shapiro Wilk Test Statistic                                                                                                              |   |        | 0.958 |                                     | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |   |        |       |   |  |
| 5521 | 5% Shapiro Wilk P Value                                                                                                                  |   |        | 0.111 |                                     | Data appear Lognormal at 5% Significance Level      |   |   |        |       |   |  |
| 5522 | Lilliefors Test Statistic                                                                                                                |   |        | 0.116 |                                     | <b>Lilliefors Lognormal GOF Test</b>                |   |   |        |       |   |  |
| 5523 | 5% Lilliefors Critical Value                                                                                                             |   |        | 0.12  |                                     | Data appear Lognormal at 5% Significance Level      |   |   |        |       |   |  |
| 5524 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5525 |                                                                                                                                          |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5526 | <b>Lognormal Statistics</b>                                                                                                              |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5527 | Minimum of Logged Data                                                                                                                   |   |        | 9.401 |                                     | Mean of logged Data                                 |   |   |        | 10.7  |   |  |
| 5528 | Maximum of Logged Data                                                                                                                   |   |        | 12.67 |                                     | SD of logged Data                                   |   |   |        | 0.581 |   |  |
| 5529 |                                                                                                                                          |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5530 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5531 | 95% H-UCL                                                                                                                                |   | 61544  |       | 90% Chebyshev (MVUE) UCL            |                                                     |   |   | 65845  |       |   |  |
| 5532 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 71874  |       | 97.5% Chebyshev (MVUE) UCL          |                                                     |   |   | 80242  |       |   |  |
| 5533 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 96680  |       |                                     |                                                     |   |   |        |       |   |  |
| 5534 |                                                                                                                                          |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5535 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5536 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5537 |                                                                                                                                          |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5538 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5539 | 95% CLT UCL                                                                                                                              |   | 64677  |       | 95% Jackknife UCL                   |                                                     |   |   | 64862  |       |   |  |
| 5540 | 95% Standard Bootstrap UCL                                                                                                               |   | 64619  |       | 95% Bootstrap-t UCL                 |                                                     |   |   | 71880  |       |   |  |
| 5541 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 108782 |       | 95% Percentile Bootstrap UCL        |                                                     |   |   | 65163  |       |   |  |
| 5542 | 95% BCA Bootstrap UCL                                                                                                                    |   | 68600  |       |                                     |                                                     |   |   |        |       |   |  |
| 5543 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 73287  |       | 95% Chebyshev(Mean, Sd) UCL         |                                                     |   |   | 81920  |       |   |  |
| 5544 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 93904  |       | 99% Chebyshev(Mean, Sd) UCL         |                                                     |   |   | 117443 |       |   |  |
| 5545 |                                                                                                                                          |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5546 | <b>Suggested UCL to Use</b>                                                                                                              |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5547 | 95% H-UCL                                                                                                                                |   | 61544  |       |                                     |                                                     |   |   |        |       |   |  |
| 5548 |                                                                                                                                          |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5549 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5550 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5551 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5552 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5553 |                                                                                                                                          |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5554 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5555 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5556 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5557 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5558 |                                                                                                                                          |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5559 |                                                                                                                                          |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5560 | <b>Result (eu4_iron_waste rock)</b>                                                                                                      |   |        |       |                                     |                                                     |   |   |        |       |   |  |
| 5561 |                                                                                                                                          |   |        |       |                                     |                                                     |   |   |        |       |   |  |

|      | A                                                                                | B | C | D      | E | F                                                               | G                                       | H | I      | J      | K | L |
|------|----------------------------------------------------------------------------------|---|---|--------|---|-----------------------------------------------------------------|-----------------------------------------|---|--------|--------|---|---|
| 5562 | <b>General Statistics</b>                                                        |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5563 | Total Number of Observations                                                     |   |   | 15     |   | Number of Distinct Observations                                 |                                         |   | 15     |        |   |   |
| 5564 |                                                                                  |   |   |        |   |                                                                 | Number of Missing Observations          |   |        | 0      |   |   |
| 5565 | Minimum                                                                          |   |   | 23500  |   | Mean                                                            |                                         |   | 78327  |        |   |   |
| 5566 | Maximum                                                                          |   |   | 262000 |   | Median                                                          |                                         |   | 53800  |        |   |   |
| 5567 | SD                                                                               |   |   | 62193  |   | Std. Error of Mean                                              |                                         |   | 16058  |        |   |   |
| 5568 | Coefficient of Variation                                                         |   |   | 0.794  |   | Skewness                                                        |                                         |   | 2.185  |        |   |   |
| 5569 |                                                                                  |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5570 | <b>Normal GOF Test</b>                                                           |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5571 | Shapiro Wilk Test Statistic                                                      |   |   | 0.739  |   | <b>Shapiro Wilk GOF Test</b>                                    |                                         |   |        |        |   |   |
| 5572 | 5% Shapiro Wilk Critical Value                                                   |   |   | 0.881  |   | Data Not Normal at 5% Significance Level                        |                                         |   |        |        |   |   |
| 5573 | Lilliefors Test Statistic                                                        |   |   | 0.285  |   | <b>Lilliefors GOF Test</b>                                      |                                         |   |        |        |   |   |
| 5574 | 5% Lilliefors Critical Value                                                     |   |   | 0.22   |   | Data Not Normal at 5% Significance Level                        |                                         |   |        |        |   |   |
| 5575 | <b>Data Not Normal at 5% Significance Level</b>                                  |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5576 |                                                                                  |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5577 | <b>Assuming Normal Distribution</b>                                              |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5578 | <b>95% Normal UCL</b>                                                            |   |   |        |   |                                                                 | <b>95% UCLs (Adjusted for Skewness)</b> |   |        |        |   |   |
| 5579 | 95% Student's-t UCL                                                              |   |   | 106610 |   | 95% Adjusted-CLT UCL (Chen-1995)                                |                                         |   | 114421 |        |   |   |
| 5580 |                                                                                  |   |   |        |   |                                                                 | 95% Modified-t UCL (Johnson-1978)       |   |        | 108120 |   |   |
| 5581 |                                                                                  |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5582 | <b>Gamma GOF Test</b>                                                            |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5583 | A-D Test Statistic                                                               |   |   | 0.696  |   | <b>Anderson-Darling Gamma GOF Test</b>                          |                                         |   |        |        |   |   |
| 5584 | 5% A-D Critical Value                                                            |   |   | 0.746  |   | Detected data appear Gamma Distributed at 5% Significance Level |                                         |   |        |        |   |   |
| 5585 | K-S Test Statistic                                                               |   |   | 0.198  |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |                                         |   |        |        |   |   |
| 5586 | 5% K-S Critical Value                                                            |   |   | 0.224  |   | Detected data appear Gamma Distributed at 5% Significance Level |                                         |   |        |        |   |   |
| 5587 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>           |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5588 |                                                                                  |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5589 | <b>Gamma Statistics</b>                                                          |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5590 | k hat (MLE)                                                                      |   |   | 2.533  |   | k star (bias corrected MLE)                                     |                                         |   | 2.071  |        |   |   |
| 5591 | Theta hat (MLE)                                                                  |   |   | 30920  |   | Theta star (bias corrected MLE)                                 |                                         |   | 37821  |        |   |   |
| 5592 | nu hat (MLE)                                                                     |   |   | 76     |   | nu star (bias corrected)                                        |                                         |   | 62.13  |        |   |   |
| 5593 | MLE Mean (bias corrected)                                                        |   |   | 78327  |   | MLE Sd (bias corrected)                                         |                                         |   | 54428  |        |   |   |
| 5594 |                                                                                  |   |   |        |   |                                                                 | Approximate Chi Square Value (0.05)     |   |        | 45     |   |   |
| 5595 | Adjusted Level of Significance                                                   |   |   | 0.0324 |   | Adjusted Chi Square Value                                       |                                         |   | 43.21  |        |   |   |
| 5596 |                                                                                  |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5597 | <b>Assuming Gamma Distribution</b>                                               |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5598 | 95% Approximate Gamma UCL (use when n>=50)                                       |   |   | 108143 |   | 95% Adjusted Gamma UCL (use when n<50)                          |                                         |   | 112627 |        |   |   |
| 5599 |                                                                                  |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5600 | <b>Lognormal GOF Test</b>                                                        |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5601 | Shapiro Wilk Test Statistic                                                      |   |   | 0.948  |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |                                         |   |        |        |   |   |
| 5602 | 5% Shapiro Wilk Critical Value                                                   |   |   | 0.881  |   | Data appear Lognormal at 5% Significance Level                  |                                         |   |        |        |   |   |
| 5603 | Lilliefors Test Statistic                                                        |   |   | 0.152  |   | <b>Lilliefors Lognormal GOF Test</b>                            |                                         |   |        |        |   |   |
| 5604 | 5% Lilliefors Critical Value                                                     |   |   | 0.22   |   | Data appear Lognormal at 5% Significance Level                  |                                         |   |        |        |   |   |
| 5605 | <b>Data appear Lognormal at 5% Significance Level</b>                            |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5606 |                                                                                  |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5607 | <b>Lognormal Statistics</b>                                                      |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5608 | Minimum of Logged Data                                                           |   |   | 10.06  |   | Mean of logged Data                                             |                                         |   | 11.06  |        |   |   |
| 5609 | Maximum of Logged Data                                                           |   |   | 12.48  |   | SD of logged Data                                               |                                         |   | 0.632  |        |   |   |
| 5610 |                                                                                  |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5611 | <b>Assuming Lognormal Distribution</b>                                           |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5612 | 95% H-UCL                                                                        |   |   | 112802 |   | 90% Chebyshev (MVUE) UCL                                        |                                         |   | 115410 |        |   |   |
| 5613 | 95% Chebyshev (MVUE) UCL                                                         |   |   | 133111 |   | 97.5% Chebyshev (MVUE) UCL                                      |                                         |   | 157678 |        |   |   |
| 5614 | 99% Chebyshev (MVUE) UCL                                                         |   |   | 205936 |   |                                                                 |                                         |   |        |        |   |   |
| 5615 |                                                                                  |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5616 | <b>Nonparametric Distribution Free UCL Statistics</b>                            |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5617 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b> |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5618 |                                                                                  |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5619 | <b>Nonparametric Distribution Free UCLs</b>                                      |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5620 | 95% CLT UCL                                                                      |   |   | 104740 |   | 95% Jackknife UCL                                               |                                         |   | 106610 |        |   |   |
| 5621 | 95% Standard Bootstrap UCL                                                       |   |   | 103548 |   | 95% Bootstrap-t UCL                                             |                                         |   | 140269 |        |   |   |
| 5622 | 95% Hall's Bootstrap UCL                                                         |   |   | 216558 |   | 95% Percentile Bootstrap UCL                                    |                                         |   | 107173 |        |   |   |
| 5623 | 95% BCA Bootstrap UCL                                                            |   |   | 114300 |   |                                                                 |                                         |   |        |        |   |   |
| 5624 | 90% Chebyshev (Mean, Sd) UCL                                                     |   |   | 126501 |   | 95% Chebyshev (Mean, Sd) UCL                                    |                                         |   | 148323 |        |   |   |
| 5625 | 97.5% Chebyshev (Mean, Sd) UCL                                                   |   |   | 178610 |   | 99% Chebyshev (Mean, Sd) UCL                                    |                                         |   | 238104 |        |   |   |
| 5626 |                                                                                  |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5627 | <b>Suggested UCL to Use</b>                                                      |   |   |        |   |                                                                 |                                         |   |        |        |   |   |
| 5628 | 95% Adjusted Gamma UCL                                                           |   |   | 112627 |   |                                                                 |                                         |   |        |        |   |   |

| A    | B                                                                                                                                        | C         | D | E | F | G                                       | H                                      | I                                                   | J     | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|-----------|---|---|---|-----------------------------------------|----------------------------------------|-----------------------------------------------------|-------|---|---|
| 5629 |                                                                                                                                          |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5630 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5631 | Recommendations are based upon data size, data distribution, and skewness.                                                               |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5632 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5633 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5634 |                                                                                                                                          |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5635 |                                                                                                                                          |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5636 | <b>Result (eu4_manganese_overnbank)</b>                                                                                                  |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5637 |                                                                                                                                          |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5638 | <b>General Statistics</b>                                                                                                                |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5639 | Total Number of Observations                                                                                                             | 54        |   |   |   |                                         |                                        | Number of Distinct Observations                     | 52    |   |   |
| 5640 |                                                                                                                                          |           |   |   |   |                                         |                                        | Number of Missing Observations                      | 0     |   |   |
| 5641 | Minimum                                                                                                                                  | 85.1      |   |   |   |                                         |                                        | Mean                                                | 1469  |   |   |
| 5642 | Maximum                                                                                                                                  | 8670      |   |   |   |                                         |                                        | Median                                              | 973   |   |   |
| 5643 | SD                                                                                                                                       | 1722      |   |   |   |                                         |                                        | Std. Error of Mean                                  | 234.4 |   |   |
| 5644 | Coefficient of Variation                                                                                                                 | 1.172     |   |   |   |                                         |                                        | Skewness                                            | 2.875 |   |   |
| 5645 |                                                                                                                                          |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5646 | <b>Normal GOF Test</b>                                                                                                                   |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5647 | Shapiro Wilk Test Statistic                                                                                                              | 0.657     |   |   |   |                                         |                                        | <b>Shapiro Wilk GOF Test</b>                        |       |   |   |
| 5648 | 5% Shapiro Wilk P Value                                                                                                                  | 1.887E-15 |   |   |   |                                         |                                        | Data Not Normal at 5% Significance Level            |       |   |   |
| 5649 | Lilliefors Test Statistic                                                                                                                | 0.229     |   |   |   |                                         |                                        | <b>Lilliefors GOF Test</b>                          |       |   |   |
| 5650 | 5% Lilliefors Critical Value                                                                                                             | 0.12      |   |   |   |                                         |                                        | Data Not Normal at 5% Significance Level            |       |   |   |
| 5651 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5652 |                                                                                                                                          |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5653 | <b>Assuming Normal Distribution</b>                                                                                                      |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5654 | <b>95% Normal UCL</b>                                                                                                                    |           |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |                                        |                                                     |       |   |   |
| 5655 | 95% Student's-t UCL                                                                                                                      | 1861      |   |   |   |                                         | 95% Adjusted-CLT UCL (Chen-1995)       | 1953                                                |       |   |   |
| 5656 |                                                                                                                                          |           |   |   |   |                                         | 95% Modified-t UCL (Johnson-1978)      | 1877                                                |       |   |   |
| 5657 |                                                                                                                                          |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5658 | <b>Gamma GOF Test</b>                                                                                                                    |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5659 | A-D Test Statistic                                                                                                                       | 1.017     |   |   |   |                                         |                                        | <b>Anderson-Darling Gamma GOF Test</b>              |       |   |   |
| 5660 | 5% A-D Critical Value                                                                                                                    | 0.774     |   |   |   |                                         |                                        | Data Not Gamma Distributed at 5% Significance Level |       |   |   |
| 5661 | K-S Test Statistic                                                                                                                       | 0.141     |   |   |   |                                         |                                        | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |       |   |   |
| 5662 | 5% K-S Critical Value                                                                                                                    | 0.124     |   |   |   |                                         |                                        | Data Not Gamma Distributed at 5% Significance Level |       |   |   |
| 5663 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5664 |                                                                                                                                          |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5665 | <b>Gamma Statistics</b>                                                                                                                  |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5666 | k hat (MLE)                                                                                                                              | 1.242     |   |   |   |                                         | k star (bias corrected MLE)            | 1.185                                               |       |   |   |
| 5667 | Theta hat (MLE)                                                                                                                          | 1183      |   |   |   |                                         | Theta star (bias corrected MLE)        | 1240                                                |       |   |   |
| 5668 | nu hat (MLE)                                                                                                                             | 134.1     |   |   |   |                                         | nu star (bias corrected)               | 128                                                 |       |   |   |
| 5669 | MLE Mean (bias corrected)                                                                                                                | 1469      |   |   |   |                                         | MLE Sd (bias corrected)                | 1350                                                |       |   |   |
| 5670 |                                                                                                                                          |           |   |   |   |                                         | Approximate Chi Square Value (0.05)    | 102.8                                               |       |   |   |
| 5671 | Adjusted Level of Significance                                                                                                           | 0.0456    |   |   |   |                                         | Adjusted Chi Square Value              | 102.2                                               |       |   |   |
| 5672 |                                                                                                                                          |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5673 | <b>Assuming Gamma Distribution</b>                                                                                                       |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5674 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | 1828      |   |   |   |                                         | 95% Adjusted Gamma UCL (use when n<50) | 1839                                                |       |   |   |
| 5675 |                                                                                                                                          |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5676 | <b>Lognormal GOF Test</b>                                                                                                                |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5677 | Shapiro Wilk Test Statistic                                                                                                              | 0.983     |   |   |   |                                         |                                        | <b>Shapiro Wilk Lognormal GOF Test</b>              |       |   |   |
| 5678 | 5% Shapiro Wilk P Value                                                                                                                  | 0.816     |   |   |   |                                         |                                        | Data appear Lognormal at 5% Significance Level      |       |   |   |
| 5679 | Lilliefors Test Statistic                                                                                                                | 0.0867    |   |   |   |                                         |                                        | <b>Lilliefors Lognormal GOF Test</b>                |       |   |   |
| 5680 | 5% Lilliefors Critical Value                                                                                                             | 0.12      |   |   |   |                                         |                                        | Data appear Lognormal at 5% Significance Level      |       |   |   |
| 5681 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5682 |                                                                                                                                          |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5683 | <b>Lognormal Statistics</b>                                                                                                              |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5684 | Minimum of Logged Data                                                                                                                   | 4.444     |   |   |   |                                         | Mean of logged Data                    | 6.838                                               |       |   |   |
| 5685 | Maximum of Logged Data                                                                                                                   | 9.068     |   |   |   |                                         | SD of logged Data                      | 0.956                                               |       |   |   |
| 5686 |                                                                                                                                          |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5687 | <b>Assuming Lognormal Distribution</b>                                                                                                   |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5688 | 95% H-UCL                                                                                                                                | 1986      |   |   |   |                                         | 90% Chebyshev (MVUE) UCL               | 2119                                                |       |   |   |
| 5689 | 95% Chebyshev (MVUE) UCL                                                                                                                 | 2419      |   |   |   |                                         | 97.5% Chebyshev (MVUE) UCL             | 2836                                                |       |   |   |
| 5690 | 99% Chebyshev (MVUE) UCL                                                                                                                 | 3654      |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5691 |                                                                                                                                          |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5692 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5693 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5694 |                                                                                                                                          |           |   |   |   |                                         |                                        |                                                     |       |   |   |
| 5695 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |           |   |   |   |                                         |                                        |                                                     |       |   |   |

| A    | B                                                                                                                                        | C | D | E                             | F    | G                                                   | H | I | J     | K                            | L    |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|-------------------------------|------|-----------------------------------------------------|---|---|-------|------------------------------|------|
| 5696 |                                                                                                                                          |   |   | 95% CLT UCL                   | 1855 |                                                     |   |   |       | 95% Jackknife UCL            | 1861 |
| 5697 |                                                                                                                                          |   |   | 95% Standard Bootstrap UCL    | 1855 |                                                     |   |   |       | 95% Bootstrap-t UCL          | 2058 |
| 5698 |                                                                                                                                          |   |   | 95% Hall's Bootstrap UCL      | 2059 |                                                     |   |   |       | 95% Percentile Bootstrap UCL | 1860 |
| 5699 |                                                                                                                                          |   |   | 95% BCA Bootstrap UCL         | 1999 |                                                     |   |   |       |                              |      |
| 5700 |                                                                                                                                          |   |   | 90% Chebyshev(Mean, Sd) UCL   | 2172 |                                                     |   |   |       | 95% Chebyshev(Mean, Sd) UCL  | 2491 |
| 5701 |                                                                                                                                          |   |   | 97.5% Chebyshev(Mean, Sd) UCL | 2933 |                                                     |   |   |       | 99% Chebyshev(Mean, Sd) UCL  | 3801 |
| 5702 |                                                                                                                                          |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5703 |                                                                                                                                          |   |   | <b>Suggested UCL to Use</b>   |      |                                                     |   |   |       |                              |      |
| 5704 |                                                                                                                                          |   |   | 95% H-UCL                     | 1986 |                                                     |   |   |       |                              |      |
| 5705 |                                                                                                                                          |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5706 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5707 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5708 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5709 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5710 |                                                                                                                                          |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5711 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5712 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5713 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5714 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5715 |                                                                                                                                          |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5716 |                                                                                                                                          |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5717 | <b>Result (eu4_manganese_waste rock)</b>                                                                                                 |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5718 |                                                                                                                                          |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5719 | <b>General Statistics</b>                                                                                                                |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5720 | Total Number of Observations                                                                                                             |   |   | 15                            |      | Number of Distinct Observations                     |   |   | 15    |                              |      |
| 5721 |                                                                                                                                          |   |   |                               |      | Number of Missing Observations                      |   |   | 0     |                              |      |
| 5722 | Minimum                                                                                                                                  |   |   | 175                           |      | Mean                                                |   |   | 7431  |                              |      |
| 5723 | Maximum                                                                                                                                  |   |   | 72100                         |      | Median                                              |   |   | 847   |                              |      |
| 5724 | SD                                                                                                                                       |   |   | 18618                         |      | Std. Error of Mean                                  |   |   | 4807  |                              |      |
| 5725 | Coefficient of Variation                                                                                                                 |   |   | 2.505                         |      | Skewness                                            |   |   | 3.42  |                              |      |
| 5726 |                                                                                                                                          |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5727 | <b>Normal GOF Test</b>                                                                                                                   |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5728 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.439                         |      | <b>Shapiro Wilk GOF Test</b>                        |   |   |       |                              |      |
| 5729 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.881                         |      | Data Not Normal at 5% Significance Level            |   |   |       |                              |      |
| 5730 | Lilliefors Test Statistic                                                                                                                |   |   | 0.421                         |      | <b>Lilliefors GOF Test</b>                          |   |   |       |                              |      |
| 5731 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.22                          |      | Data Not Normal at 5% Significance Level            |   |   |       |                              |      |
| 5732 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5733 |                                                                                                                                          |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5734 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5735 | <b>95% Normal UCL</b>                                                                                                                    |   |   |                               |      | <b>95% UCLs (Adjusted for Skewness)</b>             |   |   |       |                              |      |
| 5736 | 95% Student's-t UCL                                                                                                                      |   |   | 15898                         |      | 95% Adjusted-CLT UCL (Chen-1995)                    |   |   | 19874 |                              |      |
| 5737 |                                                                                                                                          |   |   |                               |      | 95% Modified-t UCL (Johnson-1978)                   |   |   | 16606 |                              |      |
| 5738 |                                                                                                                                          |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5739 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5740 | A-D Test Statistic                                                                                                                       |   |   | 2.131                         |      | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |       |                              |      |
| 5741 | 5% A-D Critical Value                                                                                                                    |   |   | 0.819                         |      | Data Not Gamma Distributed at 5% Significance Level |   |   |       |                              |      |
| 5742 | K-S Test Statistic                                                                                                                       |   |   | 0.364                         |      | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |       |                              |      |
| 5743 | 5% K-S Critical Value                                                                                                                    |   |   | 0.238                         |      | Data Not Gamma Distributed at 5% Significance Level |   |   |       |                              |      |
| 5744 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5745 |                                                                                                                                          |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5746 | <b>Gamma Statistics</b>                                                                                                                  |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5747 | k hat (MLE)                                                                                                                              |   |   | 0.377                         |      | k star (bias corrected MLE)                         |   |   | 0.346 |                              |      |
| 5748 | Theta hat (MLE)                                                                                                                          |   |   | 19717                         |      | Theta star (bias corrected MLE)                     |   |   | 21480 |                              |      |
| 5749 | nu hat (MLE)                                                                                                                             |   |   | 11.31                         |      | nu star (bias corrected)                            |   |   | 10.38 |                              |      |
| 5750 | MLE Mean (bias corrected)                                                                                                                |   |   | 7431                          |      | MLE Sd (bias corrected)                             |   |   | 12634 |                              |      |
| 5751 |                                                                                                                                          |   |   |                               |      | Approximate Chi Square Value (0.05)                 |   |   | 4.18  |                              |      |
| 5752 | Adjusted Level of Significance                                                                                                           |   |   | 0.0324                        |      | Adjusted Chi Square Value                           |   |   | 3.708 |                              |      |
| 5753 |                                                                                                                                          |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5754 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5755 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |   | 18452                         |      | 95% Adjusted Gamma UCL (use when n<50)              |   |   | 20803 |                              |      |
| 5756 |                                                                                                                                          |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5757 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |                               |      |                                                     |   |   |       |                              |      |
| 5758 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.835                         |      | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |   |       |                              |      |
| 5759 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.881                         |      | Data Not Lognormal at 5% Significance Level         |   |   |       |                              |      |
| 5760 | Lilliefors Test Statistic                                                                                                                |   |   | 0.275                         |      | <b>Lilliefors Lognormal GOF Test</b>                |   |   |       |                              |      |
| 5761 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.22                          |      | Data Not Lognormal at 5% Significance Level         |   |   |       |                              |      |
| 5762 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |   |   |                               |      |                                                     |   |   |       |                              |      |

| A    | B                                                                                                                                        | C | D      | E       | F                                                            | G                                                 | H | I      | J      | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|---------|--------------------------------------------------------------|---------------------------------------------------|---|--------|--------|---|---|
| 5763 |                                                                                                                                          |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5764 | <b>Lognormal Statistics</b>                                                                                                              |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5765 | Minimum of Logged Data                                                                                                                   |   |        | 5.165   |                                                              | Mean of logged Data                               |   |        | 7.151  |   |   |
| 5766 | Maximum of Logged Data                                                                                                                   |   |        | 11.19   |                                                              | SD of logged Data                                 |   |        | 1.689  |   |   |
| 5767 |                                                                                                                                          |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5768 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5769 | 95% H-UCL                                                                                                                                |   |        | 31828   |                                                              | 90% Chebyshev (MVUE) UCL                          |   |        | 11017  |   |   |
| 5770 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |        | 14014   |                                                              | 97.5% Chebyshev (MVUE) UCL                        |   |        | 18175  |   |   |
| 5771 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |        | 26348   |                                                              |                                                   |   |        |        |   |   |
| 5772 |                                                                                                                                          |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5773 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5774 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5775 |                                                                                                                                          |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5776 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5777 | 95% CLT UCL                                                                                                                              |   |        | 15338   |                                                              | 95% Jackknife UCL                                 |   |        | 15898  |   |   |
| 5778 | 95% Standard Bootstrap UCL                                                                                                               |   |        | 14977   |                                                              | 95% Bootstrap-t UCL                               |   |        | 36379  |   |   |
| 5779 | 95% Hall's Bootstrap UCL                                                                                                                 |   |        | 37891   |                                                              | 95% Percentile Bootstrap UCL                      |   |        | 16108  |   |   |
| 5780 | 95% BCA Bootstrap UCL                                                                                                                    |   |        | 21789   |                                                              |                                                   |   |        |        |   |   |
| 5781 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |        | 21853   |                                                              | 95% Chebyshev(Mean, Sd) UCL                       |   |        | 28385  |   |   |
| 5782 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |        | 37451   |                                                              | 99% Chebyshev(Mean, Sd) UCL                       |   |        | 55261  |   |   |
| 5783 |                                                                                                                                          |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5784 | <b>Suggested UCL to Use</b>                                                                                                              |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5785 | 99% Chebyshev (Mean, Sd) UCL                                                                                                             |   |        | 55261   |                                                              |                                                   |   |        |        |   |   |
| 5786 |                                                                                                                                          |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5787 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5788 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5789 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5790 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5791 |                                                                                                                                          |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5792 | <b>Result (eu4_thallium_overbank)</b>                                                                                                    |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5793 |                                                                                                                                          |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5794 | <b>General Statistics</b>                                                                                                                |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5795 | Total Number of Observations                                                                                                             |   |        | 54      |                                                              | Number of Distinct Observations                   |   |        | 38     |   |   |
| 5796 | Number of Detects                                                                                                                        |   |        | 17      |                                                              | Number of Non-Detects                             |   |        | 37     |   |   |
| 5797 | Number of Distinct Detects                                                                                                               |   |        | 14      |                                                              | Number of Distinct Non-Detects                    |   |        | 24     |   |   |
| 5798 | Minimum Detect                                                                                                                           |   |        | 0.068   |                                                              | Minimum Non-Detect                                |   |        | 0.04   |   |   |
| 5799 | Maximum Detect                                                                                                                           |   |        | 0.36    |                                                              | Maximum Non-Detect                                |   |        | 1.01   |   |   |
| 5800 | Variance Detects                                                                                                                         |   |        | 0.00735 |                                                              | Percent Non-Detects                               |   |        | 68.52% |   |   |
| 5801 | Mean Detects                                                                                                                             |   |        | 0.148   |                                                              | SD Detects                                        |   |        | 0.0858 |   |   |
| 5802 | Median Detects                                                                                                                           |   |        | 0.1     |                                                              | CV Detects                                        |   |        | 0.581  |   |   |
| 5803 | Skewness Detects                                                                                                                         |   |        | 1.403   |                                                              | Kurtosis Detects                                  |   |        | 1.044  |   |   |
| 5804 | Mean of Logged Detects                                                                                                                   |   |        | -2.043  |                                                              | SD of Logged Detects                              |   |        | 0.501  |   |   |
| 5805 |                                                                                                                                          |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5806 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5807 | Shapiro Wilk Test Statistic                                                                                                              |   |        | 0.797   |                                                              | <b>Shapiro Wilk GOF Test</b>                      |   |        |        |   |   |
| 5808 | 5% Shapiro Wilk Critical Value                                                                                                           |   |        | 0.892   |                                                              | Detected Data Not Normal at 5% Significance Level |   |        |        |   |   |
| 5809 | Lilliefors Test Statistic                                                                                                                |   |        | 0.24    |                                                              | <b>Lilliefors GOF Test</b>                        |   |        |        |   |   |
| 5810 | 5% Lilliefors Critical Value                                                                                                             |   |        | 0.207   |                                                              | Detected Data Not Normal at 5% Significance Level |   |        |        |   |   |
| 5811 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5812 |                                                                                                                                          |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5813 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5814 | KM Mean                                                                                                                                  |   | 0.0785 |         | KM Standard Error of Mean                                    |                                                   |   | 0.0106 |        |   |   |
| 5815 | KM SD                                                                                                                                    |   | 0.0713 |         | 95% KM (BCA) UCL                                             |                                                   |   | 0.1    |        |   |   |
| 5816 | 95% KM (t) UCL                                                                                                                           |   | 0.0963 |         | 95% KM (Percentile Bootstrap) UCL                            |                                                   |   | 0.097  |        |   |   |
| 5817 | 95% KM (z) UCL                                                                                                                           |   | 0.0959 |         | 95% KM Bootstrap t UCL                                       |                                                   |   | 0.103  |        |   |   |
| 5818 | 90% KM Chebyshev UCL                                                                                                                     |   | 0.11   |         | 95% KM Chebyshev UCL                                         |                                                   |   | 0.125  |        |   |   |
| 5819 | 97.5% KM Chebyshev UCL                                                                                                                   |   | 0.145  |         | 99% KM Chebyshev UCL                                         |                                                   |   | 0.184  |        |   |   |
| 5820 |                                                                                                                                          |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5821 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5822 | A-D Test Statistic                                                                                                                       |   | 1.065  |         | <b>Anderson-Darling GOF Test</b>                             |                                                   |   |        |        |   |   |
| 5823 | 5% A-D Critical Value                                                                                                                    |   | 0.743  |         | Detected Data Not Gamma Distributed at 5% Significance Level |                                                   |   |        |        |   |   |
| 5824 | K-S Test Statistic                                                                                                                       |   | 0.241  |         | <b>Kolmogorov-Smimov GOF</b>                                 |                                                   |   |        |        |   |   |
| 5825 | 5% K-S Critical Value                                                                                                                    |   | 0.21   |         | Detected Data Not Gamma Distributed at 5% Significance Level |                                                   |   |        |        |   |   |
| 5826 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                                      |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5827 |                                                                                                                                          |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5828 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |   |        |         |                                                              |                                                   |   |        |        |   |   |
| 5829 | k hat (MLE)                                                                                                                              |   | 4.003  |         | k star (bias corrected MLE)                                  |                                                   |   | 3.335  |        |   |   |



| A    | B                                                                                                                                        | C      | D                                                            | E | F      | G | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------------------------------------------------------|---|--------|---|---|---|---|---|---|
| 5897 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |                                                              |   |        |   |   |   |   |   |   |
| 5898 | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |                                                              |   |        |   |   |   |   |   |   |
| 5899 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |                                                              |   |        |   |   |   |   |   |   |
| 5900 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |                                                              |   |        |   |   |   |   |   |   |
| 5901 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 5902 | <b>Result (eu4_thallium_waste rock)</b>                                                                                                  |        |                                                              |   |        |   |   |   |   |   |   |
| 5903 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 5904 | <b>General Statistics</b>                                                                                                                |        |                                                              |   |        |   |   |   |   |   |   |
| 5905 | Total Number of Observations                                                                                                             | 15     | Number of Distinct Observations                              |   | 15     |   |   |   |   |   |   |
| 5906 | Number of Detects                                                                                                                        | 13     | Number of Non-Detects                                        |   | 2      |   |   |   |   |   |   |
| 5907 | Number of Distinct Detects                                                                                                               | 13     | Number of Distinct Non-Detects                               |   | 2      |   |   |   |   |   |   |
| 5908 | Minimum Detect                                                                                                                           | 0.13   | Minimum Non-Detect                                           |   | 0.042  |   |   |   |   |   |   |
| 5909 | Maximum Detect                                                                                                                           | 3.4    | Maximum Non-Detect                                           |   | 0.46   |   |   |   |   |   |   |
| 5910 | Variance Detects                                                                                                                         | 0.767  | Percent Non-Detects                                          |   | 13.33% |   |   |   |   |   |   |
| 5911 | Mean Detects                                                                                                                             | 0.563  | SD Detects                                                   |   | 0.876  |   |   |   |   |   |   |
| 5912 | Median Detects                                                                                                                           | 0.28   | CV Detects                                                   |   | 1.556  |   |   |   |   |   |   |
| 5913 | Skewness Detects                                                                                                                         | 3.296  | Kurtosis Detects                                             |   | 11.28  |   |   |   |   |   |   |
| 5914 | Mean of Logged Detects                                                                                                                   | -1.074 | SD of Logged Detects                                         |   | 0.863  |   |   |   |   |   |   |
| 5915 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 5916 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |        |                                                              |   |        |   |   |   |   |   |   |
| 5917 | Shapiro Wilk Test Statistic                                                                                                              | 0.493  | <b>Shapiro Wilk GOF Test</b>                                 |   |        |   |   |   |   |   |   |
| 5918 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.866  | Detected Data Not Normal at 5% Significance Level            |   |        |   |   |   |   |   |   |
| 5919 | Lilliefors Test Statistic                                                                                                                | 0.357  | <b>Lilliefors GOF Test</b>                                   |   |        |   |   |   |   |   |   |
| 5920 | 5% Lilliefors Critical Value                                                                                                             | 0.234  | Detected Data Not Normal at 5% Significance Level            |   |        |   |   |   |   |   |   |
| 5921 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |        |                                                              |   |        |   |   |   |   |   |   |
| 5922 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 5923 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |        |                                                              |   |        |   |   |   |   |   |   |
| 5924 | KM Mean                                                                                                                                  | 0.506  | KM Standard Error of Mean                                    |   | 0.215  |   |   |   |   |   |   |
| 5925 | KM SD                                                                                                                                    | 0.798  | 95% KM (BCA) UCL                                             |   | 0.911  |   |   |   |   |   |   |
| 5926 | 95% KM (t) UCL                                                                                                                           | 0.884  | 95% KM (Percentile Bootstrap) UCL                            |   | 0.91   |   |   |   |   |   |   |
| 5927 | 95% KM (z) UCL                                                                                                                           | 0.859  | 95% KM Bootstrap t UCL                                       |   | 2.307  |   |   |   |   |   |   |
| 5928 | 90% KM Chebyshev UCL                                                                                                                     | 1.15   | 95% KM Chebyshev UCL                                         |   | 1.441  |   |   |   |   |   |   |
| 5929 | 97.5% KM Chebyshev UCL                                                                                                                   | 1.846  | 99% KM Chebyshev UCL                                         |   | 2.641  |   |   |   |   |   |   |
| 5930 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 5931 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |        |                                                              |   |        |   |   |   |   |   |   |
| 5932 | A-D Test Statistic                                                                                                                       | 1.423  | <b>Anderson-Darling GOF Test</b>                             |   |        |   |   |   |   |   |   |
| 5933 | 5% A-D Critical Value                                                                                                                    | 0.755  | Detected Data Not Gamma Distributed at 5% Significance Level |   |        |   |   |   |   |   |   |
| 5934 | K-S Test Statistic                                                                                                                       | 0.278  | <b>Kolmogorov-Smimov GOF</b>                                 |   |        |   |   |   |   |   |   |
| 5935 | 5% K-S Critical Value                                                                                                                    | 0.242  | Detected Data Not Gamma Distributed at 5% Significance Level |   |        |   |   |   |   |   |   |
| 5936 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                                      |        |                                                              |   |        |   |   |   |   |   |   |
| 5937 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 5938 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |        |                                                              |   |        |   |   |   |   |   |   |
| 5939 | k hat (MLE)                                                                                                                              | 1.138  | k star (bias corrected MLE)                                  |   | 0.926  |   |   |   |   |   |   |
| 5940 | Theta hat (MLE)                                                                                                                          | 0.495  | Theta star (bias corrected MLE)                              |   | 0.608  |   |   |   |   |   |   |
| 5941 | nu hat (MLE)                                                                                                                             | 29.58  | nu star (bias corrected)                                     |   | 24.09  |   |   |   |   |   |   |
| 5942 | Mean (detects)                                                                                                                           | 0.563  |                                                              |   |        |   |   |   |   |   |   |
| 5943 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 5944 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |        |                                                              |   |        |   |   |   |   |   |   |
| 5945 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |        |                                                              |   |        |   |   |   |   |   |   |
| 5946 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |        |                                                              |   |        |   |   |   |   |   |   |
| 5947 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |        |                                                              |   |        |   |   |   |   |   |   |
| 5948 | This is especially true when the sample size is small.                                                                                   |        |                                                              |   |        |   |   |   |   |   |   |
| 5949 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |        |                                                              |   |        |   |   |   |   |   |   |
| 5950 | Minimum                                                                                                                                  | 0.01   | Mean                                                         |   | 0.497  |   |   |   |   |   |   |
| 5951 | Maximum                                                                                                                                  | 3.4    | Median                                                       |   | 0.27   |   |   |   |   |   |   |
| 5952 | SD                                                                                                                                       | 0.83   | CV                                                           |   | 1.668  |   |   |   |   |   |   |
| 5953 | k hat (MLE)                                                                                                                              | 0.87   | k star (bias corrected MLE)                                  |   | 0.74   |   |   |   |   |   |   |
| 5954 | Theta hat (MLE)                                                                                                                          | 0.572  | Theta star (bias corrected MLE)                              |   | 0.672  |   |   |   |   |   |   |
| 5955 | nu hat (MLE)                                                                                                                             | 26.1   | nu star (bias corrected)                                     |   | 22.21  |   |   |   |   |   |   |
| 5956 | Adjusted Level of Significance ( $\beta$ )                                                                                               | 0.0324 |                                                              |   |        |   |   |   |   |   |   |
| 5957 | Approximate Chi Square Value (22.21, $\alpha$ )                                                                                          | 12.5   | Adjusted Chi Square Value (22.21, $\beta$ )                  |   | 11.61  |   |   |   |   |   |   |
| 5958 | 95% Gamma Approximate UCL (use when n>=50)                                                                                               | 0.884  | 95% Gamma Adjusted UCL (use when n<50)                       |   | 0.952  |   |   |   |   |   |   |
| 5959 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 5960 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |        |                                                              |   |        |   |   |   |   |   |   |
| 5961 | Mean (KM)                                                                                                                                | 0.506  | SD (KM)                                                      |   | 0.798  |   |   |   |   |   |   |
| 5962 | Variance (KM)                                                                                                                            | 0.637  | SE of Mean (KM)                                              |   | 0.215  |   |   |   |   |   |   |
| 5963 | k hat (KM)                                                                                                                               | 0.402  | k star (KM)                                                  |   | 0.366  |   |   |   |   |   |   |

|      | A                                                                                                                                        | B | C | D | E                                                   | F      | G                           | H | I | J | K                                                       | L      |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|-----------------------------------------------------|--------|-----------------------------|---|---|---|---------------------------------------------------------|--------|
| 5964 |                                                                                                                                          |   |   |   | nu hat (KM)                                         | 12.07  |                             |   |   |   | nu star (KM)                                            | 10.99  |
| 5965 |                                                                                                                                          |   |   |   | theta hat (KM)                                      | 1.258  |                             |   |   |   | theta star (KM)                                         | 1.382  |
| 5966 |                                                                                                                                          |   |   |   | 80% gamma percentile (KM)                           | 0.807  |                             |   |   |   | 90% gamma percentile (KM)                               | 1.451  |
| 5967 |                                                                                                                                          |   |   |   | 95% gamma percentile (KM)                           | 2.167  |                             |   |   |   | 99% gamma percentile (KM)                               | 3.986  |
| 5968 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 5969 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 5970 |                                                                                                                                          |   |   |   | Approximate Chi Square Value (10.99, $\alpha$ )     | 4.569  |                             |   |   |   | Adjusted Chi Square Value (10.99, $\beta$ )             | 4.071  |
| 5971 |                                                                                                                                          |   |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ ) | 1.217  |                             |   |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )          | 1.366  |
| 5972 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 5973 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 5974 |                                                                                                                                          |   |   |   | Shapiro Wilk Test Statistic                         | 0.851  |                             |   |   |   | <b>Shapiro Wilk GOF Test</b>                            |        |
| 5975 |                                                                                                                                          |   |   |   | 5% Shapiro Wilk Critical Value                      | 0.866  |                             |   |   |   | Detected Data Not Lognormal at 5% Significance Level    |        |
| 5976 |                                                                                                                                          |   |   |   | Lilliefors Test Statistic                           | 0.208  |                             |   |   |   | <b>Lilliefors GOF Test</b>                              |        |
| 5977 |                                                                                                                                          |   |   |   | 5% Lilliefors Critical Value                        | 0.234  |                             |   |   |   | Detected Data appear Lognormal at 5% Significance Level |        |
| 5978 | <b>Detected Data appear Approximate Lognormal at 5% Significance Level</b>                                                               |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 5979 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 5980 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 5981 |                                                                                                                                          |   |   |   | Mean in Original Scale                              | 0.507  |                             |   |   |   | Mean in Log Scale                                       | -1.228 |
| 5982 |                                                                                                                                          |   |   |   | SD in Original Scale                                | 0.825  |                             |   |   |   | SD in Log Scale                                         | 0.939  |
| 5983 |                                                                                                                                          |   |   |   | 95% t UCL (assumes normality of ROS data)           | 0.882  |                             |   |   |   | 95% Percentile Bootstrap UCL                            | 0.929  |
| 5984 |                                                                                                                                          |   |   |   | 95% BCA Bootstrap UCL                               | 1.093  |                             |   |   |   | 95% Bootstrap t UCL                                     | 2.391  |
| 5985 |                                                                                                                                          |   |   |   | 95% H-UCL (Log ROS)                                 | 0.884  |                             |   |   |   |                                                         |        |
| 5986 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 5987 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 5988 |                                                                                                                                          |   |   |   | KM Mean (logged)                                    | -1.249 |                             |   |   |   | KM Geo Mean                                             | 0.287  |
| 5989 |                                                                                                                                          |   |   |   | KM SD (logged)                                      | 0.948  |                             |   |   |   | 95% Critical H Value (KM-Log)                           | 2.663  |
| 5990 |                                                                                                                                          |   |   |   | KM Standard Error of Mean (logged)                  | 0.258  |                             |   |   |   | 95% H-UCL (KM -Log)                                     | 0.883  |
| 5991 |                                                                                                                                          |   |   |   | KM SD (logged)                                      | 0.948  |                             |   |   |   | 95% Critical H Value (KM-Log)                           | 2.663  |
| 5992 |                                                                                                                                          |   |   |   | KM Standard Error of Mean (logged)                  | 0.258  |                             |   |   |   |                                                         |        |
| 5993 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 5994 | <b>DL/2 Statistics</b>                                                                                                                   |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 5995 | <b>DL/2 Normal</b>                                                                                                                       |   |   |   |                                                     |        | <b>DL/2 Log-Transformed</b> |   |   |   |                                                         |        |
| 5996 |                                                                                                                                          |   |   |   | Mean in Original Scale                              | 0.505  |                             |   |   |   | Mean in Log Scale                                       | -1.287 |
| 5997 |                                                                                                                                          |   |   |   | SD in Original Scale                                | 0.826  |                             |   |   |   | SD in Log Scale                                         | 1.075  |
| 5998 |                                                                                                                                          |   |   |   | 95% t UCL (Assumes normality)                       | 0.881  |                             |   |   |   | 95% H-Stat UCL                                          | 1.122  |
| 5999 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 6000 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 6001 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 6002 | <b>Detected Data appear Approximate Lognormal Distributed at 5% Significance Level</b>                                                   |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 6003 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 6004 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 6005 |                                                                                                                                          |   |   |   | KM H-UCL                                            | 0.883  |                             |   |   |   |                                                         |        |
| 6006 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 6007 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 6008 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 6009 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 6010 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 6011 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 6012 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 6013 | <b>Result (eu4_zinc_overbank)</b>                                                                                                        |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 6014 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 6015 | <b>General Statistics</b>                                                                                                                |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 6016 |                                                                                                                                          |   |   |   | Total Number of Observations                        | 54     |                             |   |   |   | Number of Distinct Observations                         | 54     |
| 6017 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |   | Number of Missing Observations                          | 0      |
| 6018 |                                                                                                                                          |   |   |   | Minimum                                             | 45.1   |                             |   |   |   | Mean                                                    | 387.7  |
| 6019 |                                                                                                                                          |   |   |   | Maximum                                             | 5260   |                             |   |   |   | Median                                                  | 173    |
| 6020 |                                                                                                                                          |   |   |   | SD                                                  | 751.3  |                             |   |   |   | Std. Error of Mean                                      | 102.2  |
| 6021 |                                                                                                                                          |   |   |   | Coefficient of Variation                            | 1.938  |                             |   |   |   | Skewness                                                | 5.515  |
| 6022 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 6023 | <b>Normal GOF Test</b>                                                                                                                   |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 6024 |                                                                                                                                          |   |   |   | Shapiro Wilk Test Statistic                         | 0.422  |                             |   |   |   | <b>Shapiro Wilk GOF Test</b>                            |        |
| 6025 |                                                                                                                                          |   |   |   | 5% Shapiro Wilk P Value                             | 0      |                             |   |   |   | Data Not Normal at 5% Significance Level                |        |
| 6026 |                                                                                                                                          |   |   |   | Lilliefors Test Statistic                           | 0.324  |                             |   |   |   | <b>Lilliefors GOF Test</b>                              |        |
| 6027 |                                                                                                                                          |   |   |   | 5% Lilliefors Critical Value                        | 0.12   |                             |   |   |   | Data Not Normal at 5% Significance Level                |        |
| 6028 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 6029 |                                                                                                                                          |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |
| 6030 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |   |                                                     |        |                             |   |   |   |                                                         |        |

| A    | B                                                                                                                                         | C | D | E      | F                                                   | G                                       | H | I     | J | K     | L |  |
|------|-------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------|-----------------------------------------|---|-------|---|-------|---|--|
| 6031 | <b>95% Normal UCL</b>                                                                                                                     |   |   |        |                                                     | <b>95% UCLs (Adjusted for Skewness)</b> |   |       |   |       |   |  |
| 6032 | 95% Student's-t UCL                                                                                                                       |   |   |        | 558.9                                               | 95% Adjusted-CLT UCL (Chen-1995)        |   |       |   | 637.9 |   |  |
| 6033 |                                                                                                                                           |   |   |        |                                                     | 95% Modified-t UCL (Johnson-1978)       |   |       |   | 571.7 |   |  |
| 6034 |                                                                                                                                           |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6035 | <b>Gamma GOF Test</b>                                                                                                                     |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6036 | A-D Test Statistic                                                                                                                        |   |   | 2.616  | <b>Anderson-Darling Gamma GOF Test</b>              |                                         |   |       |   |       |   |  |
| 6037 | 5% A-D Critical Value                                                                                                                     |   |   | 0.783  | Data Not Gamma Distributed at 5% Significance Level |                                         |   |       |   |       |   |  |
| 6038 | K-S Test Statistic                                                                                                                        |   |   | 0.155  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |                                         |   |       |   |       |   |  |
| 6039 | 5% K-S Critical Value                                                                                                                     |   |   | 0.125  | Data Not Gamma Distributed at 5% Significance Level |                                         |   |       |   |       |   |  |
| 6040 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                                |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6041 |                                                                                                                                           |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6042 | <b>Gamma Statistics</b>                                                                                                                   |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6043 | k hat (MLE)                                                                                                                               |   |   | 0.937  | k star (bias corrected MLE)                         |                                         |   | 0.897 |   |       |   |  |
| 6044 | Theta hat (MLE)                                                                                                                           |   |   | 413.8  | Theta star (bias corrected MLE)                     |                                         |   | 432.1 |   |       |   |  |
| 6045 | nu hat (MLE)                                                                                                                              |   |   | 101.2  | nu star (bias corrected)                            |                                         |   | 96.91 |   |       |   |  |
| 6046 | MLE Mean (bias corrected)                                                                                                                 |   |   | 387.7  | MLE Sd (bias corrected)                             |                                         |   | 409.3 |   |       |   |  |
| 6047 |                                                                                                                                           |   |   |        | Approximate Chi Square Value (0.05)                 |                                         |   | 75.21 |   |       |   |  |
| 6048 | Adjusted Level of Significance                                                                                                            |   |   | 0.0456 | Adjusted Chi Square Value                           |                                         |   | 74.68 |   |       |   |  |
| 6049 |                                                                                                                                           |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6050 | <b>Assuming Gamma Distribution</b>                                                                                                        |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6051 | 95% Approximate Gamma UCL (use when n>=50))                                                                                               |   |   | 499.6  | 95% Adjusted Gamma UCL (use when n<50)              |                                         |   | 503.1 |   |       |   |  |
| 6052 |                                                                                                                                           |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6053 | <b>Lognormal GOF Test</b>                                                                                                                 |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6054 | Shapiro Wilk Test Statistic                                                                                                               |   |   | 0.949  | <b>Shapiro Wilk Lognormal GOF Test</b>              |                                         |   |       |   |       |   |  |
| 6055 | 5% Shapiro Wilk P Value                                                                                                                   |   |   | 0.0422 | Data Not Lognormal at 5% Significance Level         |                                         |   |       |   |       |   |  |
| 6056 | Lilliefors Test Statistic                                                                                                                 |   |   | 0.106  | <b>Lilliefors Lognormal GOF Test</b>                |                                         |   |       |   |       |   |  |
| 6057 | 5% Lilliefors Critical Value                                                                                                              |   |   | 0.12   | Data appear Lognormal at 5% Significance Level      |                                         |   |       |   |       |   |  |
| 6058 | <b>Data appear Approximate Lognormal at 5% Significance Level</b>                                                                         |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6059 |                                                                                                                                           |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6060 | <b>Lognormal Statistics</b>                                                                                                               |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6061 | Minimum of Logged Data                                                                                                                    |   |   | 3.809  | Mean of logged Data                                 |                                         |   | 5.34  |   |       |   |  |
| 6062 | Maximum of Logged Data                                                                                                                    |   |   | 8.568  | SD of logged Data                                   |                                         |   | 0.978 |   |       |   |  |
| 6063 |                                                                                                                                           |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6064 | <b>Assuming Lognormal Distribution</b>                                                                                                    |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6065 | 95% H-UCL                                                                                                                                 |   |   | 458.1  | 90% Chebyshev (MVUE) UCL                            |                                         |   | 487.7 |   |       |   |  |
| 6066 | 95% Chebyshev (MVUE) UCL                                                                                                                  |   |   | 558.2  | 97.5% Chebyshev (MVUE) UCL                          |                                         |   | 656   |   |       |   |  |
| 6067 | 99% Chebyshev (MVUE) UCL                                                                                                                  |   |   | 848.1  |                                                     |                                         |   |       |   |       |   |  |
| 6068 |                                                                                                                                           |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6069 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                     |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6070 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                          |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6071 |                                                                                                                                           |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6072 | <b>Nonparametric Distribution Free UCLs</b>                                                                                               |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6073 | 95% CLT UCL                                                                                                                               |   |   | 555.9  | 95% Jackknife UCL                                   |                                         |   | 558.9 |   |       |   |  |
| 6074 | 95% Standard Bootstrap UCL                                                                                                                |   |   | 554.5  | 95% Bootstrap-t UCL                                 |                                         |   | 812.5 |   |       |   |  |
| 6075 | 95% Hall's Bootstrap UCL                                                                                                                  |   |   | 1204   | 95% Percentile Bootstrap UCL                        |                                         |   | 573   |   |       |   |  |
| 6076 | 95% BCA Bootstrap UCL                                                                                                                     |   |   | 676.8  |                                                     |                                         |   |       |   |       |   |  |
| 6077 | 90% Chebyshev(Mean, Sd) UCL                                                                                                               |   |   | 694.4  | 95% Chebyshev(Mean, Sd) UCL                         |                                         |   | 833.4 |   |       |   |  |
| 6078 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                             |   |   | 1026   | 99% Chebyshev(Mean, Sd) UCL                         |                                         |   | 1405  |   |       |   |  |
| 6079 |                                                                                                                                           |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6080 | <b>Suggested UCL to Use</b>                                                                                                               |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6081 | 95% H-UCL                                                                                                                                 |   |   | 458.1  |                                                     |                                         |   |       |   |       |   |  |
| 6082 |                                                                                                                                           |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6083 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6084 | Recommendations are based upon data size, data distribution, and skewness.                                                                |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6085 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6086 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6087 |                                                                                                                                           |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6088 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                    |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6089 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>             |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6090 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                        |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6091 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>         |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6092 |                                                                                                                                           |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6093 |                                                                                                                                           |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6094 | <b>Result (eu4_zinc_waste rock)</b>                                                                                                       |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6095 |                                                                                                                                           |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6096 | <b>General Statistics</b>                                                                                                                 |   |   |        |                                                     |                                         |   |       |   |       |   |  |
| 6097 | Total Number of Observations                                                                                                              |   |   | 15     | Number of Distinct Observations                     |                                         |   | 15    |   |       |   |  |

|      | A                                                                                                                            | B | C | D | E                                           | F      | G                              | H | I | J                                                   | K | L     |
|------|------------------------------------------------------------------------------------------------------------------------------|---|---|---|---------------------------------------------|--------|--------------------------------|---|---|-----------------------------------------------------|---|-------|
| 6098 |                                                                                                                              |   |   |   |                                             |        | Number of Missing Observations |   |   |                                                     |   | 0     |
| 6099 |                                                                                                                              |   |   |   | Minimum                                     | 23.6   |                                |   |   | Mean                                                |   | 7598  |
| 6100 |                                                                                                                              |   |   |   | Maximum                                     | 66800  |                                |   |   | Median                                              |   | 903   |
| 6101 |                                                                                                                              |   |   |   | SD                                          | 17252  |                                |   |   | Std. Error of Mean                                  |   | 4454  |
| 6102 |                                                                                                                              |   |   |   | Coefficient of Variation                    | 2.271  |                                |   |   | Skewness                                            |   | 3.284 |
| 6103 |                                                                                                                              |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6104 | <b>Normal GOF Test</b>                                                                                                       |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6105 |                                                                                                                              |   |   |   | Shapiro Wilk Test Statistic                 | 0.494  |                                |   |   | <b>Shapiro Wilk GOF Test</b>                        |   |       |
| 6106 |                                                                                                                              |   |   |   | 5% Shapiro Wilk Critical Value              | 0.881  |                                |   |   | Data Not Normal at 5% Significance Level            |   |       |
| 6107 |                                                                                                                              |   |   |   | Lilliefors Test Statistic                   | 0.361  |                                |   |   | <b>Lilliefors GOF Test</b>                          |   |       |
| 6108 |                                                                                                                              |   |   |   | 5% Lilliefors Critical Value                | 0.22   |                                |   |   | Data Not Normal at 5% Significance Level            |   |       |
| 6109 | <b>Data Not Normal at 5% Significance Level</b>                                                                              |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6110 |                                                                                                                              |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6111 | <b>Assuming Normal Distribution</b>                                                                                          |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6112 |                                                                                                                              |   |   |   | <b>95% Normal UCL</b>                       |        |                                |   |   | <b>95% UCLs (Adjusted for Skewness)</b>             |   |       |
| 6113 |                                                                                                                              |   |   |   | 95% Student's-t UCL                         | 15443  |                                |   |   | 95% Adjusted-CLT UCL (Chen-1995)                    |   | 18960 |
| 6114 |                                                                                                                              |   |   |   |                                             |        |                                |   |   | 95% Modified-t UCL (Johnson-1978)                   |   | 16073 |
| 6115 |                                                                                                                              |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6116 | <b>Gamma GOF Test</b>                                                                                                        |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6117 |                                                                                                                              |   |   |   | A-D Test Statistic                          | 0.979  |                                |   |   | <b>Anderson-Darling Gamma GOF Test</b>              |   |       |
| 6118 |                                                                                                                              |   |   |   | 5% A-D Critical Value                       | 0.828  |                                |   |   | Data Not Gamma Distributed at 5% Significance Level |   |       |
| 6119 |                                                                                                                              |   |   |   | K-S Test Statistic                          | 0.249  |                                |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |       |
| 6120 |                                                                                                                              |   |   |   | 5% K-S Critical Value                       | 0.239  |                                |   |   | Data Not Gamma Distributed at 5% Significance Level |   |       |
| 6121 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6122 |                                                                                                                              |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6123 | <b>Gamma Statistics</b>                                                                                                      |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6124 |                                                                                                                              |   |   |   | k hat (MLE)                                 | 0.335  |                                |   |   | k star (bias corrected MLE)                         |   | 0.312 |
| 6125 |                                                                                                                              |   |   |   | Theta hat (MLE)                             | 22710  |                                |   |   | Theta star (bias corrected MLE)                     |   | 24345 |
| 6126 |                                                                                                                              |   |   |   | nu hat (MLE)                                | 10.04  |                                |   |   | nu star (bias corrected)                            |   | 9.362 |
| 6127 |                                                                                                                              |   |   |   | MLE Mean (bias corrected)                   | 7598   |                                |   |   | MLE Sd (bias corrected)                             |   | 13600 |
| 6128 |                                                                                                                              |   |   |   |                                             |        |                                |   |   | Approximate Chi Square Value (0.05)                 |   | 3.547 |
| 6129 |                                                                                                                              |   |   |   | Adjusted Level of Significance              | 0.0324 |                                |   |   | Adjusted Chi Square Value                           |   | 3.12  |
| 6130 |                                                                                                                              |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6131 | <b>Assuming Gamma Distribution</b>                                                                                           |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6132 |                                                                                                                              |   |   |   | 95% Approximate Gamma UCL (use when n>=50)) | 20052  |                                |   |   | 95% Adjusted Gamma UCL (use when n<50)              |   | 22802 |
| 6133 |                                                                                                                              |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6134 | <b>Lognormal GOF Test</b>                                                                                                    |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6135 |                                                                                                                              |   |   |   | Shapiro Wilk Test Statistic                 | 0.964  |                                |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |       |
| 6136 |                                                                                                                              |   |   |   | 5% Shapiro Wilk Critical Value              | 0.881  |                                |   |   | Data appear Lognormal at 5% Significance Level      |   |       |
| 6137 |                                                                                                                              |   |   |   | Lilliefors Test Statistic                   | 0.13   |                                |   |   | <b>Lilliefors Lognormal GOF Test</b>                |   |       |
| 6138 |                                                                                                                              |   |   |   | 5% Lilliefors Critical Value                | 0.22   |                                |   |   | Data appear Lognormal at 5% Significance Level      |   |       |
| 6139 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                        |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6140 |                                                                                                                              |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6141 | <b>Lognormal Statistics</b>                                                                                                  |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6142 |                                                                                                                              |   |   |   | Minimum of Logged Data                      | 3.161  |                                |   |   | Mean of logged Data                                 |   | 6.911 |
| 6143 |                                                                                                                              |   |   |   | Maximum of Logged Data                      | 11.11  |                                |   |   | SD of logged Data                                   |   | 2.193 |
| 6144 |                                                                                                                              |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6145 | <b>Assuming Lognormal Distribution</b>                                                                                       |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6146 |                                                                                                                              |   |   |   | 95% H-UCL                                   | 200866 |                                |   |   | 90% Chebyshev (MVUE) UCL                            |   | 21849 |
| 6147 |                                                                                                                              |   |   |   | 95% Chebyshev (MVUE) UCL                    | 28380  |                                |   |   | 97.5% Chebyshev (MVUE) UCL                          |   | 37444 |
| 6148 |                                                                                                                              |   |   |   | 99% Chebyshev (MVUE) UCL                    | 55249  |                                |   |   |                                                     |   |       |
| 6149 |                                                                                                                              |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6150 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                        |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6151 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                             |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6152 |                                                                                                                              |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6153 | <b>Nonparametric Distribution Free UCLs</b>                                                                                  |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6154 |                                                                                                                              |   |   |   | 95% CLT UCL                                 | 14924  |                                |   |   | 95% Jackknife UCL                                   |   | 15443 |
| 6155 |                                                                                                                              |   |   |   | 95% Standard Bootstrap UCL                  | 14607  |                                |   |   | 95% Bootstrap-t UCL                                 |   | 31845 |
| 6156 |                                                                                                                              |   |   |   | 95% Hall's Bootstrap UCL                    | 38530  |                                |   |   | 95% Percentile Bootstrap UCL                        |   | 15587 |
| 6157 |                                                                                                                              |   |   |   | 95% BCA Bootstrap UCL                       | 20974  |                                |   |   |                                                     |   |       |
| 6158 |                                                                                                                              |   |   |   | 90% Chebyshev(Mean, Sd) UCL                 | 20961  |                                |   |   | 95% Chebyshev(Mean, Sd) UCL                         |   | 27014 |
| 6159 |                                                                                                                              |   |   |   | 97.5% Chebyshev(Mean, Sd) UCL               | 35415  |                                |   |   | 99% Chebyshev(Mean, Sd) UCL                         |   | 51919 |
| 6160 |                                                                                                                              |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6161 | <b>Suggested UCL to Use</b>                                                                                                  |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6162 |                                                                                                                              |   |   |   | 99% Chebyshev (Mean, Sd) UCL                | 51919  |                                |   |   |                                                     |   |       |
| 6163 |                                                                                                                              |   |   |   |                                             |        |                                |   |   |                                                     |   |       |
| 6164 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. |   |   |   |                                             |        |                                |   |   |                                                     |   |       |

|      | A                                                                                                                                       | B | C | D | E | F | G | H | I | J | K | L |
|------|-----------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---|---|---|
| 6165 | Recommendations are based upon data size, data distribution, and skewness.                                                              |   |   |   |   |   |   |   |   |   |   |   |
| 6166 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                |   |   |   |   |   |   |   |   |   |   |   |
| 6167 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statisticia |   |   |   |   |   |   |   |   |   |   |   |
| 6168 |                                                                                                                                         |   |   |   |   |   |   |   |   |   |   |   |

| A  | B                                                                 | C                                     | D | E | F | G                                       | H | I                                                   | J     | K | L |  |
|----|-------------------------------------------------------------------|---------------------------------------|---|---|---|-----------------------------------------|---|-----------------------------------------------------|-------|---|---|--|
| 1  | <b>UCL Statistics for Data Sets with Non-Detects</b>              |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 2  |                                                                   |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 3  | User Selected Options                                             |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 4  | Date/Time of Computation                                          | ProUCL 5.12/4/2019 11:15:39 AM        |   |   |   |                                         |   |                                                     |       |   |   |  |
| 5  | From File                                                         | BPMD_HHRA_RoadWayWorker_SoilInput.xls |   |   |   |                                         |   |                                                     |       |   |   |  |
| 6  | Full Precision                                                    | OFF                                   |   |   |   |                                         |   |                                                     |       |   |   |  |
| 7  | Confidence Coefficient                                            | 95%                                   |   |   |   |                                         |   |                                                     |       |   |   |  |
| 8  | Number of Bootstrap Operations                                    | 2000                                  |   |   |   |                                         |   |                                                     |       |   |   |  |
| 9  |                                                                   |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 10 |                                                                   |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 11 | <b>Result (eu1_antimony_roadway)</b>                              |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 12 |                                                                   |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 13 | <b>General Statistics</b>                                         |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 14 | Total Number of Observations                                      | 35                                    |   |   |   |                                         |   | Number of Distinct Observations                     | 32    |   |   |  |
| 15 |                                                                   |                                       |   |   |   |                                         |   | Number of Missing Observations                      | 0     |   |   |  |
| 16 | Minimum                                                           | 0.34                                  |   |   |   |                                         |   | Mean                                                | 11.31 |   |   |  |
| 17 | Maximum                                                           | 187                                   |   |   |   |                                         |   | Median                                              | 1.9   |   |   |  |
| 18 | SD                                                                | 33.79                                 |   |   |   |                                         |   | Std. Error of Mean                                  | 5.711 |   |   |  |
| 19 | Coefficient of Variation                                          | 2.987                                 |   |   |   |                                         |   | Skewness                                            | 4.608 |   |   |  |
| 20 |                                                                   |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 21 | <b>Normal GOF Test</b>                                            |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 22 | Shapiro Wilk Test Statistic                                       | 0.354                                 |   |   |   |                                         |   | <b>Shapiro Wilk GOF Test</b>                        |       |   |   |  |
| 23 | 5% Shapiro Wilk Critical Value                                    | 0.934                                 |   |   |   |                                         |   | Data Not Normal at 5% Significance Level            |       |   |   |  |
| 24 | Lilliefors Test Statistic                                         | 0.44                                  |   |   |   |                                         |   | <b>Lilliefors GOF Test</b>                          |       |   |   |  |
| 25 | 5% Lilliefors Critical Value                                      | 0.148                                 |   |   |   |                                         |   | Data Not Normal at 5% Significance Level            |       |   |   |  |
| 26 | <b>Data Not Normal at 5% Significance Level</b>                   |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 27 |                                                                   |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 28 | <b>Assuming Normal Distribution</b>                               |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 29 | <b>95% Normal UCL</b>                                             |                                       |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |                                                     |       |   |   |  |
| 30 | 95% Student's-t UCL                                               | 20.97                                 |   |   |   |                                         |   | 95% Adjusted-CLT UCL (Chen-1995)                    | 25.46 |   |   |  |
| 31 |                                                                   |                                       |   |   |   |                                         |   | 95% Modified-t UCL (Johnson-1978)                   | 21.71 |   |   |  |
| 32 |                                                                   |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 33 | <b>Gamma GOF Test</b>                                             |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 34 | A-D Test Statistic                                                | 4.491                                 |   |   |   |                                         |   | <b>Anderson-Darling Gamma GOF Test</b>              |       |   |   |  |
| 35 | 5% A-D Critical Value                                             | 0.829                                 |   |   |   |                                         |   | Data Not Gamma Distributed at 5% Significance Level |       |   |   |  |
| 36 | K-S Test Statistic                                                | 0.303                                 |   |   |   |                                         |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |       |   |   |  |
| 37 | 5% K-S Critical Value                                             | 0.159                                 |   |   |   |                                         |   | Data Not Gamma Distributed at 5% Significance Level |       |   |   |  |
| 38 | <b>Data Not Gamma Distributed at 5% Significance Level</b>        |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 39 |                                                                   |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 40 | <b>Gamma Statistics</b>                                           |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 41 | k hat (MLE)                                                       | 0.424                                 |   |   |   |                                         |   | k star (bias corrected MLE)                         | 0.406 |   |   |  |
| 42 | Theta hat (MLE)                                                   | 26.71                                 |   |   |   |                                         |   | Theta star (bias corrected MLE)                     | 27.84 |   |   |  |
| 43 | nu hat (MLE)                                                      | 29.65                                 |   |   |   |                                         |   | nu star (bias corrected)                            | 28.44 |   |   |  |
| 44 | MLE Mean (bias corrected)                                         | 11.31                                 |   |   |   |                                         |   | MLE Sd (bias corrected)                             | 17.75 |   |   |  |
| 45 |                                                                   |                                       |   |   |   |                                         |   | Approximate Chi Square Value (0.05)                 | 17.27 |   |   |  |
| 46 | Adjusted Level of Significance                                    | 0.0425                                |   |   |   |                                         |   | Adjusted Chi Square Value                           | 16.86 |   |   |  |
| 47 |                                                                   |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 48 | <b>Assuming Gamma Distribution</b>                                |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 49 | 95% Approximate Gamma UCL (use when n>=50))                       | 18.63                                 |   |   |   |                                         |   | 95% Adjusted Gamma UCL (use when n<50)              | 19.09 |   |   |  |
| 50 |                                                                   |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 51 | <b>Lognormal GOF Test</b>                                         |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 52 | Shapiro Wilk Test Statistic                                       | 0.879                                 |   |   |   |                                         |   | <b>Shapiro Wilk Lognormal GOF Test</b>              |       |   |   |  |
| 53 | 5% Shapiro Wilk Critical Value                                    | 0.934                                 |   |   |   |                                         |   | Data Not Lognormal at 5% Significance Level         |       |   |   |  |
| 54 | Lilliefors Test Statistic                                         | 0.145                                 |   |   |   |                                         |   | <b>Lilliefors Lognormal GOF Test</b>                |       |   |   |  |
| 55 | 5% Lilliefors Critical Value                                      | 0.148                                 |   |   |   |                                         |   | Data appear Lognormal at 5% Significance Level      |       |   |   |  |
| 56 | <b>Data appear Approximate Lognormal at 5% Significance Level</b> |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 57 |                                                                   |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 58 | <b>Lognormal Statistics</b>                                       |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 59 | Minimum of Logged Data                                            | -1.079                                |   |   |   |                                         |   | Mean of logged Data                                 | 0.887 |   |   |  |
| 60 | Maximum of Logged Data                                            | 5.231                                 |   |   |   |                                         |   | SD of logged Data                                   | 1.435 |   |   |  |
| 61 |                                                                   |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 62 | <b>Assuming Lognormal Distribution</b>                            |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 63 | 95% H-UCL                                                         | 14.36                                 |   |   |   |                                         |   | 90% Chebyshev (MVUE) UCL                            | 12.37 |   |   |  |
| 64 | 95% Chebyshev (MVUE) UCL                                          | 15.05                                 |   |   |   |                                         |   | 97.5% Chebyshev (MVUE) UCL                          | 18.79 |   |   |  |
| 65 | 99% Chebyshev (MVUE) UCL                                          | 26.11                                 |   |   |   |                                         |   |                                                     |       |   |   |  |
| 66 |                                                                   |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |
| 67 | <b>Nonparametric Distribution Free UCL Statistics</b>             |                                       |   |   |   |                                         |   |                                                     |       |   |   |  |

|     | A                                                                                                                                        | B | C | D                                       | E                                                               | F | G | H     | I | J | K | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---|-----------------------------------------|-----------------------------------------------------------------|---|---|-------|---|---|---|---|
| 68  | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 69  |                                                                                                                                          |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 70  | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 71  | 95% CLT UCL                                                                                                                              |   |   | 20.71                                   | 95% Jackknife UCL                                               |   |   | 20.97 |   |   |   |   |
| 72  | 95% Standard Bootstrap UCL                                                                                                               |   |   | 20.6                                    | 95% Bootstrap-t UCL                                             |   |   | 48.9  |   |   |   |   |
| 73  | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 50.56                                   | 95% Percentile Bootstrap UCL                                    |   |   | 21.26 |   |   |   |   |
| 74  | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 27.15                                   |                                                                 |   |   |       |   |   |   |   |
| 75  | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 28.45                                   | 95% Chebyshev(Mean, Sd) UCL                                     |   |   | 36.21 |   |   |   |   |
| 76  | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 46.98                                   | 99% Chebyshev(Mean, Sd) UCL                                     |   |   | 68.14 |   |   |   |   |
| 77  |                                                                                                                                          |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 78  | <b>Suggested UCL to Use</b>                                                                                                              |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 79  | 95% H-UCL                                                                                                                                |   |   | 14.36                                   |                                                                 |   |   |       |   |   |   |   |
| 80  |                                                                                                                                          |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 81  | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 82  | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 83  | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 84  | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 85  |                                                                                                                                          |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 86  | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 87  | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 88  | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 89  | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 90  |                                                                                                                                          |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 91  |                                                                                                                                          |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 92  | <b>Result (eu1_arsenic_roadway)</b>                                                                                                      |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 93  |                                                                                                                                          |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 94  | <b>General Statistics</b>                                                                                                                |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 95  | Total Number of Observations                                                                                                             |   |   | 35                                      | Number of Distinct Observations                                 |   |   | 34    |   |   |   |   |
| 96  |                                                                                                                                          |   |   |                                         | Number of Missing Observations                                  |   |   | 0     |   |   |   |   |
| 97  | Minimum                                                                                                                                  |   |   | 8.6                                     | Mean                                                            |   |   | 64.91 |   |   |   |   |
| 98  | Maximum                                                                                                                                  |   |   | 259                                     | Median                                                          |   |   | 54.1  |   |   |   |   |
| 99  | SD                                                                                                                                       |   |   | 47.32                                   | Std. Error of Mean                                              |   |   | 7.999 |   |   |   |   |
| 100 | Coefficient of Variation                                                                                                                 |   |   | 0.729                                   | Skewness                                                        |   |   | 2.477 |   |   |   |   |
| 101 |                                                                                                                                          |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 102 | <b>Normal GOF Test</b>                                                                                                                   |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 103 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.775                                   | <b>Shapiro Wilk GOF Test</b>                                    |   |   |       |   |   |   |   |
| 104 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.934                                   | Data Not Normal at 5% Significance Level                        |   |   |       |   |   |   |   |
| 105 | Lilliefors Test Statistic                                                                                                                |   |   | 0.215                                   | <b>Lilliefors GOF Test</b>                                      |   |   |       |   |   |   |   |
| 106 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.148                                   | Data Not Normal at 5% Significance Level                        |   |   |       |   |   |   |   |
| 107 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 108 |                                                                                                                                          |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 109 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 110 | <b>95% Normal UCL</b>                                                                                                                    |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |                                                                 |   |   |       |   |   |   |   |
| 111 | 95% Student's-t UCL                                                                                                                      |   |   | 78.44                                   | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   | 81.65 |   |   |   |   |
| 112 |                                                                                                                                          |   |   |                                         | 95% Modified-t UCL (Johnson-1978)                               |   |   | 79    |   |   |   |   |
| 113 |                                                                                                                                          |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 114 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 115 | A-D Test Statistic                                                                                                                       |   |   | 0.54                                    | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |       |   |   |   |   |
| 116 | 5% A-D Critical Value                                                                                                                    |   |   | 0.757                                   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |   |
| 117 | K-S Test Statistic                                                                                                                       |   |   | 0.13                                    | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |       |   |   |   |   |
| 118 | 5% K-S Critical Value                                                                                                                    |   |   | 0.15                                    | Detected data appear Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |   |
| 119 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 120 |                                                                                                                                          |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 121 | <b>Gamma Statistics</b>                                                                                                                  |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 122 | k hat (MLE)                                                                                                                              |   |   | 2.494                                   | k star (bias corrected MLE)                                     |   |   | 2.299 |   |   |   |   |
| 123 | Theta hat (MLE)                                                                                                                          |   |   | 26.03                                   | Theta star (bias corrected MLE)                                 |   |   | 28.23 |   |   |   |   |
| 124 | nu hat (MLE)                                                                                                                             |   |   | 174.6                                   | nu star (bias corrected)                                        |   |   | 161   |   |   |   |   |
| 125 | MLE Mean (bias corrected)                                                                                                                |   |   | 64.91                                   | MLE Sd (bias corrected)                                         |   |   | 42.81 |   |   |   |   |
| 126 |                                                                                                                                          |   |   |                                         | Approximate Chi Square Value (0.05)                             |   |   | 132.6 |   |   |   |   |
| 127 | Adjusted Level of Significance                                                                                                           |   |   | 0.0425                                  | Adjusted Chi Square Value                                       |   |   | 131.4 |   |   |   |   |
| 128 |                                                                                                                                          |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 129 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 130 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   |   | 78.78                                   | 95% Adjusted Gamma UCL (use when n<50)                          |   |   | 79.51 |   |   |   |   |
| 131 |                                                                                                                                          |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 132 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |                                         |                                                                 |   |   |       |   |   |   |   |
| 133 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.95                                    | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |       |   |   |   |   |
| 134 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.934                                   | Data appear Lognormal at 5% Significance Level                  |   |   |       |   |   |   |   |

| A   | B                                                                                                                                        | C | D                              | E     | F                                       | G                                                               | H | I                                 | J | K | L     |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|--------------------------------|-------|-----------------------------------------|-----------------------------------------------------------------|---|-----------------------------------|---|---|-------|
| 135 |                                                                                                                                          |   | Lilliefors Test Statistic      | 0.107 |                                         | <b>Lilliefors Lognormal GOF Test</b>                            |   |                                   |   |   |       |
| 136 |                                                                                                                                          |   | 5% Lilliefors Critical Value   | 0.148 |                                         | Data appear Lognormal at 5% Significance Level                  |   |                                   |   |   |       |
| 137 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 138 |                                                                                                                                          |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 139 | <b>Lognormal Statistics</b>                                                                                                              |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 140 |                                                                                                                                          |   | Minimum of Logged Data         | 2.152 |                                         |                                                                 |   | Mean of logged Data               |   |   | 3.959 |
| 141 |                                                                                                                                          |   | Maximum of Logged Data         | 5.557 |                                         |                                                                 |   | SD of logged Data                 |   |   | 0.688 |
| 142 |                                                                                                                                          |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 143 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 144 |                                                                                                                                          |   | 95% H-UCL                      | 85.18 |                                         |                                                                 |   | 90% Chebyshev (MVUE) UCL          |   |   | 90.74 |
| 145 |                                                                                                                                          |   | 95% Chebyshev (MVUE) UCL       | 102   |                                         |                                                                 |   | 97.5% Chebyshev (MVUE) UCL        |   |   | 117.7 |
| 146 |                                                                                                                                          |   | 99% Chebyshev (MVUE) UCL       | 148.4 |                                         |                                                                 |   |                                   |   |   |       |
| 147 |                                                                                                                                          |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 148 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 149 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 150 |                                                                                                                                          |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 151 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 152 |                                                                                                                                          |   | 95% CLT UCL                    | 78.07 |                                         |                                                                 |   | 95% Jackknife UCL                 |   |   | 78.44 |
| 153 |                                                                                                                                          |   | 95% Standard Bootstrap UCL     | 77.51 |                                         |                                                                 |   | 95% Bootstrap-t UCL               |   |   | 84.04 |
| 154 |                                                                                                                                          |   | 95% Hall's Bootstrap UCL       | 143.5 |                                         |                                                                 |   | 95% Percentile Bootstrap UCL      |   |   | 78.89 |
| 155 |                                                                                                                                          |   | 95% BCA Bootstrap UCL          | 82.21 |                                         |                                                                 |   |                                   |   |   |       |
| 156 |                                                                                                                                          |   | 90% Chebyshev(Mean, Sd) UCL    | 88.91 |                                         |                                                                 |   | 95% Chebyshev(Mean, Sd) UCL       |   |   | 99.78 |
| 157 |                                                                                                                                          |   | 97.5% Chebyshev(Mean, Sd) UCL  | 114.9 |                                         |                                                                 |   | 99% Chebyshev(Mean, Sd) UCL       |   |   | 144.5 |
| 158 |                                                                                                                                          |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 159 | <b>Suggested UCL to Use</b>                                                                                                              |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 160 |                                                                                                                                          |   | 95% Adjusted Gamma UCL         | 79.51 |                                         |                                                                 |   |                                   |   |   |       |
| 161 |                                                                                                                                          |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 162 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 163 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 164 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 165 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 166 |                                                                                                                                          |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 167 |                                                                                                                                          |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 168 | <b>Result (eu1_cadmium_roadway)</b>                                                                                                      |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 169 |                                                                                                                                          |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 170 | <b>General Statistics</b>                                                                                                                |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 171 |                                                                                                                                          |   | Total Number of Observations   | 35    |                                         |                                                                 |   | Number of Distinct Observations   |   |   | 29    |
| 172 |                                                                                                                                          |   |                                |       |                                         |                                                                 |   | Number of Missing Observations    |   |   | 0     |
| 173 |                                                                                                                                          |   | Minimum                        | 0.073 |                                         |                                                                 |   | Mean                              |   |   | 3.146 |
| 174 |                                                                                                                                          |   | Maximum                        | 16.4  |                                         |                                                                 |   | Median                            |   |   | 2.2   |
| 175 |                                                                                                                                          |   | SD                             | 3.238 |                                         |                                                                 |   | Std. Error of Mean                |   |   | 0.547 |
| 176 |                                                                                                                                          |   | Coefficient of Variation       | 1.029 |                                         |                                                                 |   | Skewness                          |   |   | 2.512 |
| 177 |                                                                                                                                          |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 178 | <b>Normal GOF Test</b>                                                                                                                   |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 179 |                                                                                                                                          |   | Shapiro Wilk Test Statistic    | 0.736 |                                         | <b>Shapiro Wilk GOF Test</b>                                    |   |                                   |   |   |       |
| 180 |                                                                                                                                          |   | 5% Shapiro Wilk Critical Value | 0.934 |                                         | Data Not Normal at 5% Significance Level                        |   |                                   |   |   |       |
| 181 |                                                                                                                                          |   | Lilliefors Test Statistic      | 0.269 |                                         | <b>Lilliefors GOF Test</b>                                      |   |                                   |   |   |       |
| 182 |                                                                                                                                          |   | 5% Lilliefors Critical Value   | 0.148 |                                         | Data Not Normal at 5% Significance Level                        |   |                                   |   |   |       |
| 183 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 184 |                                                                                                                                          |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 185 | <b>Assuming Normal Distribution</b>                                                                                                      |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 186 | <b>95% Normal UCL</b>                                                                                                                    |   |                                |       | <b>95% UCLs (Adjusted for Skewness)</b> |                                                                 |   |                                   |   |   |       |
| 187 |                                                                                                                                          |   | 95% Student's-t UCL            | 4.072 |                                         |                                                                 |   | 95% Adjusted-CLT UCL (Chen-1995)  |   |   | 4.295 |
| 188 |                                                                                                                                          |   |                                |       |                                         |                                                                 |   | 95% Modified-t UCL (Johnson-1978) |   |   | 4.111 |
| 189 |                                                                                                                                          |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 190 | <b>Gamma GOF Test</b>                                                                                                                    |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 191 |                                                                                                                                          |   | A-D Test Statistic             | 0.683 |                                         | <b>Anderson-Darling Gamma GOF Test</b>                          |   |                                   |   |   |       |
| 192 |                                                                                                                                          |   | 5% A-D Critical Value          | 0.772 |                                         | detected data appear Gamma Distributed at 5% Significance Level |   |                                   |   |   |       |
| 193 |                                                                                                                                          |   | K-S Test Statistic             | 0.148 |                                         | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |                                   |   |   |       |
| 194 |                                                                                                                                          |   | 5% K-S Critical Value          | 0.152 |                                         | detected data appear Gamma Distributed at 5% Significance Level |   |                                   |   |   |       |
| 195 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 196 |                                                                                                                                          |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 197 | <b>Gamma Statistics</b>                                                                                                                  |   |                                |       |                                         |                                                                 |   |                                   |   |   |       |
| 198 |                                                                                                                                          |   | k hat (MLE)                    | 1.219 |                                         |                                                                 |   | k star (bias corrected MLE)       |   |   | 1.133 |
| 199 |                                                                                                                                          |   | Theta hat (MLE)                | 2.582 |                                         |                                                                 |   | Theta star (bias corrected MLE)   |   |   | 2.776 |
| 200 |                                                                                                                                          |   | nu hat (MLE)                   | 85.31 |                                         |                                                                 |   | nu star (bias corrected)          |   |   | 79.33 |
| 201 |                                                                                                                                          |   | MLE Mean (bias corrected)      | 3.146 |                                         |                                                                 |   | MLE Sd (bias corrected)           |   |   | 2.956 |

| A   | B                                                                                                                                        | C | D | E      | F | G                                                               | H | I | J | K | L     |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|---|-----------------------------------------------------------------|---|---|---|---|-------|
| 202 |                                                                                                                                          |   |   |        |   | Approximate Chi Square Value (0.05)                             |   |   |   |   | 59.81 |
| 203 | Adjusted Level of Significance                                                                                                           |   |   | 0.0425 |   | Adjusted Chi Square Value                                       |   |   |   |   | 59    |
| 204 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |
| 205 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |        |   |                                                                 |   |   |   |   |       |
| 206 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   |   | 4.173  |   | 95% Adjusted Gamma UCL (use when n<50)                          |   |   |   |   | 4.23  |
| 207 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |
| 208 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |        |   |                                                                 |   |   |   |   |       |
| 209 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.92   |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |   |   |       |
| 210 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.934  |   | Data Not Lognormal at 5% Significance Level                     |   |   |   |   |       |
| 211 | Lilliefors Test Statistic                                                                                                                |   |   | 0.183  |   | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |   |   |       |
| 212 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.148  |   | Data Not Lognormal at 5% Significance Level                     |   |   |   |   |       |
| 213 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |   |   |        |   |                                                                 |   |   |   |   |       |
| 214 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |
| 215 | <b>Lognormal Statistics</b>                                                                                                              |   |   |        |   |                                                                 |   |   |   |   |       |
| 216 | Minimum of Logged Data                                                                                                                   |   |   | -2.617 |   | Mean of logged Data                                             |   |   |   |   | 0.683 |
| 217 | Maximum of Logged Data                                                                                                                   |   |   | 2.797  |   | SD of logged Data                                               |   |   |   |   | 1.107 |
| 218 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |
| 219 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |        |   |                                                                 |   |   |   |   |       |
| 220 | 95% H-UCL                                                                                                                                |   |   | 5.974  |   | 90% Chebyshev (MVUE) UCL                                        |   |   |   |   | 5.925 |
| 221 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 6.998  |   | 97.5% Chebyshev (MVUE) UCL                                      |   |   |   |   | 8.487 |
| 222 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 11.41  |   |                                                                 |   |   |   |   |       |
| 223 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |
| 224 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |   |                                                                 |   |   |   |   |       |
| 225 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |        |   |                                                                 |   |   |   |   |       |
| 226 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |
| 227 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |        |   |                                                                 |   |   |   |   |       |
| 228 | 95% CLT UCL                                                                                                                              |   |   | 4.047  |   | 95% Jackknife UCL                                               |   |   |   |   | 4.072 |
| 229 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 4.019  |   | 95% Bootstrap-t UCL                                             |   |   |   |   | 4.518 |
| 230 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 4.789  |   | 95% Percentile Bootstrap UCL                                    |   |   |   |   | 4.097 |
| 231 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 4.325  |   |                                                                 |   |   |   |   |       |
| 232 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 4.788  |   | 95% Chebyshev(Mean, Sd) UCL                                     |   |   |   |   | 5.532 |
| 233 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 6.564  |   | 99% Chebyshev(Mean, Sd) UCL                                     |   |   |   |   | 8.592 |
| 234 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |
| 235 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |   |                                                                 |   |   |   |   |       |
| 236 | 95% Adjusted Gamma UCL                                                                                                                   |   |   | 4.23   |   |                                                                 |   |   |   |   |       |
| 237 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |
| 238 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |   |                                                                 |   |   |   |   |       |
| 239 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |   |                                                                 |   |   |   |   |       |
| 240 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |   |                                                                 |   |   |   |   |       |
| 241 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |   |                                                                 |   |   |   |   |       |
| 242 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |
| 243 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |
| 244 | <b>Result (eu1_chromium_roadway)</b>                                                                                                     |   |   |        |   |                                                                 |   |   |   |   |       |
| 245 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |
| 246 | <b>General Statistics</b>                                                                                                                |   |   |        |   |                                                                 |   |   |   |   |       |
| 247 | Total Number of Observations                                                                                                             |   |   | 35     |   | Number of Distinct Observations                                 |   |   |   |   | 25    |
| 248 |                                                                                                                                          |   |   |        |   | Number of Missing Observations                                  |   |   |   |   | 0     |
| 249 | Minimum                                                                                                                                  |   |   | 2.2    |   | Mean                                                            |   |   |   |   | 5     |
| 250 | Maximum                                                                                                                                  |   |   | 15.7   |   | Median                                                          |   |   |   |   | 4.7   |
| 251 | SD                                                                                                                                       |   |   | 2.524  |   | Std. Error of Mean                                              |   |   |   |   | 0.427 |
| 252 | Coefficient of Variation                                                                                                                 |   |   | 0.505  |   | Skewness                                                        |   |   |   |   | 2.321 |
| 253 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |
| 254 | <b>Normal GOF Test</b>                                                                                                                   |   |   |        |   |                                                                 |   |   |   |   |       |
| 255 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.801  |   | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |   |       |
| 256 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.934  |   | Data Not Normal at 5% Significance Level                        |   |   |   |   |       |
| 257 | Lilliefors Test Statistic                                                                                                                |   |   | 0.198  |   | <b>Lilliefors GOF Test</b>                                      |   |   |   |   |       |
| 258 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.148  |   | Data Not Normal at 5% Significance Level                        |   |   |   |   |       |
| 259 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |
| 260 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |
| 261 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |        |   |                                                                 |   |   |   |   |       |
| 262 | <b>95% Normal UCL</b>                                                                                                                    |   |   |        |   | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |   |   |       |
| 263 | 95% Student's-t UCL                                                                                                                      |   |   | 5.721  |   | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |   |   | 5.88  |
| 264 |                                                                                                                                          |   |   |        |   | 95% Modified-t UCL (Johnson-1978)                               |   |   |   |   | 5.749 |
| 265 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |   |       |
| 266 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |        |   |                                                                 |   |   |   |   |       |
| 267 | A-D Test Statistic                                                                                                                       |   |   | 0.71   |   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |   |   |       |
| 268 | 5% A-D Critical Value                                                                                                                    |   |   | 0.75   |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |   |       |

|     | A                                                                                                                                        | B | C | D      | E                                                               | F | G | H     | I | J | K | L |  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------------------|---|---|-------|---|---|---|---|--|
| 269 | K-S Test Statistic                                                                                                                       |   |   | 0.138  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |       |   |   |   |   |  |
| 270 | 5% K-S Critical Value                                                                                                                    |   |   | 0.149  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |   |  |
| 271 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 272 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 273 | <b>Gamma Statistics</b>                                                                                                                  |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 274 | k hat (MLE)                                                                                                                              |   |   | 5.237  | k star (bias corrected MLE)                                     |   |   | 4.807 |   |   |   |   |  |
| 275 | Theta hat (MLE)                                                                                                                          |   |   | 0.955  | Theta star (bias corrected MLE)                                 |   |   | 1.04  |   |   |   |   |  |
| 276 | nu hat (MLE)                                                                                                                             |   |   | 366.6  | nu star (bias corrected)                                        |   |   | 336.5 |   |   |   |   |  |
| 277 | MLE Mean (bias corrected)                                                                                                                |   |   | 5      | MLE Sd (bias corrected)                                         |   |   | 2.281 |   |   |   |   |  |
| 278 |                                                                                                                                          |   |   |        | Approximate Chi Square Value (0.05)                             |   |   | 295   |   |   |   |   |  |
| 279 | Adjusted Level of Significance                                                                                                           |   |   | 0.0425 | Adjusted Chi Square Value                                       |   |   | 293.1 |   |   |   |   |  |
| 280 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 281 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 282 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   |   | 5.703  | 95% Adjusted Gamma UCL (use when n<50)                          |   |   | 5.739 |   |   |   |   |  |
| 283 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 284 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 285 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.945  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |       |   |   |   |   |  |
| 286 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.934  | Data appear Lognormal at 5% Significance Level                  |   |   |       |   |   |   |   |  |
| 287 | Lilliefors Test Statistic                                                                                                                |   |   | 0.122  | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |       |   |   |   |   |  |
| 288 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.148  | Data appear Lognormal at 5% Significance Level                  |   |   |       |   |   |   |   |  |
| 289 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 290 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 291 | <b>Lognormal Statistics</b>                                                                                                              |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 292 | Minimum of Logged Data                                                                                                                   |   |   | 0.788  | Mean of logged Data                                             |   |   | 1.511 |   |   |   |   |  |
| 293 | Maximum of Logged Data                                                                                                                   |   |   | 2.754  | SD of logged Data                                               |   |   | 0.44  |   |   |   |   |  |
| 294 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 295 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 296 | 95% H-UCL                                                                                                                                |   |   | 5.758  | 90% Chebyshev (MVUE) UCL                                        |   |   | 6.125 |   |   |   |   |  |
| 297 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 6.646  | 97.5% Chebyshev (MVUE) UCL                                      |   |   | 7.369 |   |   |   |   |  |
| 298 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 8.788  |                                                                 |   |   |       |   |   |   |   |  |
| 299 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 300 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 301 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 302 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 303 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 304 | 95% CLT UCL                                                                                                                              |   |   | 5.702  | 95% Jackknife UCL                                               |   |   | 5.721 |   |   |   |   |  |
| 305 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 5.7    | 95% Bootstrap-t UCL                                             |   |   | 5.996 |   |   |   |   |  |
| 306 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 6.449  | 95% Percentile Bootstrap UCL                                    |   |   | 5.737 |   |   |   |   |  |
| 307 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 5.914  |                                                                 |   |   |       |   |   |   |   |  |
| 308 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 6.28   | 95% Chebyshev(Mean, Sd) UCL                                     |   |   | 6.859 |   |   |   |   |  |
| 309 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 7.664  | 99% Chebyshev(Mean, Sd) UCL                                     |   |   | 9.245 |   |   |   |   |  |
| 310 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 311 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 312 | 95% Adjusted Gamma UCL                                                                                                                   |   |   | 5.739  |                                                                 |   |   |       |   |   |   |   |  |
| 313 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 314 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 315 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 316 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 317 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 318 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 319 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 320 | <b>Result (eu1_cobalt_roadway)</b>                                                                                                       |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 321 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 322 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 323 | Total Number of Observations                                                                                                             |   |   | 35     | Number of Distinct Observations                                 |   |   | 31    |   |   |   |   |  |
| 324 |                                                                                                                                          |   |   |        | Number of Missing Observations                                  |   |   | 0     |   |   |   |   |  |
| 325 | Minimum                                                                                                                                  |   |   | 2.7    | Mean                                                            |   |   | 9.863 |   |   |   |   |  |
| 326 | Maximum                                                                                                                                  |   |   | 43.6   | Median                                                          |   |   | 7.6   |   |   |   |   |  |
| 327 | SD                                                                                                                                       |   |   | 7.72   | Std. Error of Mean                                              |   |   | 1.305 |   |   |   |   |  |
| 328 | Coefficient of Variation                                                                                                                 |   |   | 0.783  | Skewness                                                        |   |   | 2.833 |   |   |   |   |  |
| 329 |                                                                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 330 | <b>Normal GOF Test</b>                                                                                                                   |   |   |        |                                                                 |   |   |       |   |   |   |   |  |
| 331 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.713  | <b>Shapiro Wilk GOF Test</b>                                    |   |   |       |   |   |   |   |  |
| 332 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.934  | Data Not Normal at 5% Significance Level                        |   |   |       |   |   |   |   |  |
| 333 | Lilliefors Test Statistic                                                                                                                |   |   | 0.225  | <b>Lilliefors GOF Test</b>                                      |   |   |       |   |   |   |   |  |
| 334 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.148  | Data Not Normal at 5% Significance Level                        |   |   |       |   |   |   |   |  |
| 335 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |        |                                                                 |   |   |       |   |   |   |   |  |

| A   | B                                                                                                                                        | C | D     | E      | F                               | G                                                   | H                                      | I | J     | K     | L     |  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|-------|--------|---------------------------------|-----------------------------------------------------|----------------------------------------|---|-------|-------|-------|--|
| 336 |                                                                                                                                          |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 337 | <b>Assuming Normal Distribution</b>                                                                                                      |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 338 | <b>95% Normal UCL</b>                                                                                                                    |   |       |        |                                 | <b>95% UCLs (Adjusted for Skewness)</b>             |                                        |   |       |       |       |  |
| 339 | 95% Student's-t UCL                                                                                                                      |   |       | 12.07  |                                 | 95% Adjusted-CLT UCL (Chen-1995)                    |                                        |   |       | 12.68 |       |  |
| 340 |                                                                                                                                          |   |       |        |                                 | 95% Modified-t UCL (Johnson-1978)                   |                                        |   |       | 12.17 |       |  |
| 341 |                                                                                                                                          |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 342 | <b>Gamma GOF Test</b>                                                                                                                    |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 343 | A-D Test Statistic                                                                                                                       |   |       | 1.08   |                                 | <b>Anderson-Darling Gamma GOF Test</b>              |                                        |   |       |       |       |  |
| 344 | 5% A-D Critical Value                                                                                                                    |   |       | 0.755  |                                 | Data Not Gamma Distributed at 5% Significance Level |                                        |   |       |       |       |  |
| 345 | K-S Test Statistic                                                                                                                       |   |       | 0.172  |                                 | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |                                        |   |       |       |       |  |
| 346 | 5% K-S Critical Value                                                                                                                    |   |       | 0.15   |                                 | Data Not Gamma Distributed at 5% Significance Level |                                        |   |       |       |       |  |
| 347 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 348 |                                                                                                                                          |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 349 | <b>Gamma Statistics</b>                                                                                                                  |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 350 | k hat (MLE)                                                                                                                              |   | 2.72  |        | k star (bias corrected MLE)     |                                                     |                                        |   | 2.506 |       |       |  |
| 351 | Theta hat (MLE)                                                                                                                          |   | 3.626 |        | Theta star (bias corrected MLE) |                                                     |                                        |   | 3.936 |       |       |  |
| 352 | nu hat (MLE)                                                                                                                             |   | 190.4 |        | nu star (bias corrected)        |                                                     |                                        |   | 175.4 |       |       |  |
| 353 | MLE Mean (bias corrected)                                                                                                                |   |       | 9.863  |                                 | MLE Sd (bias corrected)                             |                                        |   |       | 6.23  |       |  |
| 354 |                                                                                                                                          |   |       |        |                                 | Approximate Chi Square Value (0.05)                 |                                        |   |       | 145.8 |       |  |
| 355 | Adjusted Level of Significance                                                                                                           |   |       | 0.0425 |                                 | Adjusted Chi Square Value                           |                                        |   |       | 144.5 |       |  |
| 356 |                                                                                                                                          |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 357 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 358 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |       |        | 11.87                           |                                                     | 95% Adjusted Gamma UCL (use when n<50) |   |       |       | 11.97 |  |
| 359 |                                                                                                                                          |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 360 | <b>Lognormal GOF Test</b>                                                                                                                |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 361 | Shapiro Wilk Test Statistic                                                                                                              |   |       | 0.963  |                                 | <b>Shapiro Wilk Lognormal GOF Test</b>              |                                        |   |       |       |       |  |
| 362 | 5% Shapiro Wilk Critical Value                                                                                                           |   |       | 0.934  |                                 | Data appear Lognormal at 5% Significance Level      |                                        |   |       |       |       |  |
| 363 | Lilliefors Test Statistic                                                                                                                |   |       | 0.13   |                                 | <b>Lilliefors Lognormal GOF Test</b>                |                                        |   |       |       |       |  |
| 364 | 5% Lilliefors Critical Value                                                                                                             |   |       | 0.148  |                                 | Data appear Lognormal at 5% Significance Level      |                                        |   |       |       |       |  |
| 365 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 366 |                                                                                                                                          |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 367 | <b>Lognormal Statistics</b>                                                                                                              |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 368 | Minimum of Logged Data                                                                                                                   |   |       | 0.993  |                                 | Mean of logged Data                                 |                                        |   |       | 2.094 |       |  |
| 369 | Maximum of Logged Data                                                                                                                   |   |       | 3.775  |                                 | SD of logged Data                                   |                                        |   |       | 0.596 |       |  |
| 370 |                                                                                                                                          |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 371 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 372 | 95% H-UCL                                                                                                                                |   | 11.92 |        | 90% Chebyshev (MVUE) UCL        |                                                     |                                        |   | 12.73 |       |       |  |
| 373 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 14.13 |        | 97.5% Chebyshev (MVUE) UCL      |                                                     |                                        |   | 16.08 |       |       |  |
| 374 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 19.9  |        |                                 |                                                     |                                        |   |       |       |       |  |
| 375 |                                                                                                                                          |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 376 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 377 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 378 |                                                                                                                                          |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 379 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 380 | 95% CLT UCL                                                                                                                              |   | 12.01 |        | 95% Jackknife UCL               |                                                     |                                        |   | 12.07 |       |       |  |
| 381 | 95% Standard Bootstrap UCL                                                                                                               |   | 11.99 |        | 95% Bootstrap-t UCL             |                                                     |                                        |   | 13.61 |       |       |  |
| 382 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 15.27 |        | 95% Percentile Bootstrap UCL    |                                                     |                                        |   | 12.16 |       |       |  |
| 383 | 95% BCA Bootstrap UCL                                                                                                                    |   | 13.05 |        |                                 |                                                     |                                        |   |       |       |       |  |
| 384 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 13.78 |        | 95% Chebyshev(Mean, Sd) UCL     |                                                     |                                        |   | 15.55 |       |       |  |
| 385 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 18.01 |        | 99% Chebyshev(Mean, Sd) UCL     |                                                     |                                        |   | 22.85 |       |       |  |
| 386 |                                                                                                                                          |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 387 | <b>Suggested UCL to Use</b>                                                                                                              |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 388 | 95% H-UCL                                                                                                                                |   | 11.92 |        |                                 |                                                     |                                        |   |       |       |       |  |
| 389 |                                                                                                                                          |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 390 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 391 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 392 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 393 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 394 |                                                                                                                                          |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 395 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 396 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 397 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 398 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 399 |                                                                                                                                          |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 400 |                                                                                                                                          |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 401 | <b>Result (eu1_iron_roadway)</b>                                                                                                         |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |
| 402 |                                                                                                                                          |   |       |        |                                 |                                                     |                                        |   |       |       |       |  |

|     | A                                                                                | B | C | D      | E | F                                                   | G | H | I     | J | K | L |
|-----|----------------------------------------------------------------------------------|---|---|--------|---|-----------------------------------------------------|---|---|-------|---|---|---|
| 403 | <b>General Statistics</b>                                                        |   |   |        |   |                                                     |   |   |       |   |   |   |
| 404 | Total Number of Observations                                                     |   |   | 35     |   | Number of Distinct Observations                     |   |   | 33    |   |   |   |
| 405 |                                                                                  |   |   |        |   | Number of Missing Observations                      |   |   | 0     |   |   |   |
| 406 | Minimum                                                                          |   |   | 16800  |   | Mean                                                |   |   | 28146 |   |   |   |
| 407 | Maximum                                                                          |   |   | 60600  |   | Median                                              |   |   | 25900 |   |   |   |
| 408 | SD                                                                               |   |   | 10194  |   | Std. Error of Mean                                  |   |   | 1723  |   |   |   |
| 409 | Coefficient of Variation                                                         |   |   | 0.362  |   | Skewness                                            |   |   | 1.592 |   |   |   |
| 410 |                                                                                  |   |   |        |   |                                                     |   |   |       |   |   |   |
| 411 | <b>Normal GOF Test</b>                                                           |   |   |        |   |                                                     |   |   |       |   |   |   |
| 412 | Shapiro Wilk Test Statistic                                                      |   |   | 0.838  |   | <b>Shapiro Wilk GOF Test</b>                        |   |   |       |   |   |   |
| 413 | 5% Shapiro Wilk Critical Value                                                   |   |   | 0.934  |   | Data Not Normal at 5% Significance Level            |   |   |       |   |   |   |
| 414 | Lilliefors Test Statistic                                                        |   |   | 0.219  |   | <b>Lilliefors GOF Test</b>                          |   |   |       |   |   |   |
| 415 | 5% Lilliefors Critical Value                                                     |   |   | 0.148  |   | Data Not Normal at 5% Significance Level            |   |   |       |   |   |   |
| 416 | <b>Data Not Normal at 5% Significance Level</b>                                  |   |   |        |   |                                                     |   |   |       |   |   |   |
| 417 |                                                                                  |   |   |        |   |                                                     |   |   |       |   |   |   |
| 418 | <b>Assuming Normal Distribution</b>                                              |   |   |        |   |                                                     |   |   |       |   |   |   |
| 419 | <b>95% Normal UCL</b>                                                            |   |   |        |   | <b>95% UCLs (Adjusted for Skewness)</b>             |   |   |       |   |   |   |
| 420 | 95% Student's-t UCL                                                              |   |   | 31059  |   | 95% Adjusted-CLT UCL (Chen-1995)                    |   |   | 31475 |   |   |   |
| 421 |                                                                                  |   |   |        |   | 95% Modified-t UCL (Johnson-1978)                   |   |   | 31137 |   |   |   |
| 422 |                                                                                  |   |   |        |   |                                                     |   |   |       |   |   |   |
| 423 | <b>Gamma GOF Test</b>                                                            |   |   |        |   |                                                     |   |   |       |   |   |   |
| 424 | A-D Test Statistic                                                               |   |   | 1.08   |   | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |       |   |   |   |
| 425 | 5% A-D Critical Value                                                            |   |   | 0.748  |   | Data Not Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |
| 426 | K-S Test Statistic                                                               |   |   | 0.171  |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |       |   |   |   |
| 427 | 5% K-S Critical Value                                                            |   |   | 0.149  |   | Data Not Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |
| 428 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                       |   |   |        |   |                                                     |   |   |       |   |   |   |
| 429 |                                                                                  |   |   |        |   |                                                     |   |   |       |   |   |   |
| 430 | <b>Gamma Statistics</b>                                                          |   |   |        |   |                                                     |   |   |       |   |   |   |
| 431 | k hat (MLE)                                                                      |   |   | 9.682  |   | k star (bias corrected MLE)                         |   |   | 8.872 |   |   |   |
| 432 | Theta hat (MLE)                                                                  |   |   | 2907   |   | Theta star (bias corrected MLE)                     |   |   | 3173  |   |   |   |
| 433 | nu hat (MLE)                                                                     |   |   | 677.8  |   | nu star (bias corrected)                            |   |   | 621   |   |   |   |
| 434 | MLE Mean (bias corrected)                                                        |   |   | 28146  |   | MLE Sd (bias corrected)                             |   |   | 9450  |   |   |   |
| 435 |                                                                                  |   |   |        |   | Approximate Chi Square Value (0.05)                 |   |   | 564.2 |   |   |   |
| 436 | Adjusted Level of Significance                                                   |   |   | 0.0425 |   | Adjusted Chi Square Value                           |   |   | 561.6 |   |   |   |
| 437 |                                                                                  |   |   |        |   |                                                     |   |   |       |   |   |   |
| 438 | <b>Assuming Gamma Distribution</b>                                               |   |   |        |   |                                                     |   |   |       |   |   |   |
| 439 | 95% Approximate Gamma UCL (use when n>=50))                                      |   |   | 30980  |   | 95% Adjusted Gamma UCL (use when n<50)              |   |   | 31121 |   |   |   |
| 440 |                                                                                  |   |   |        |   |                                                     |   |   |       |   |   |   |
| 441 | <b>Lognormal GOF Test</b>                                                        |   |   |        |   |                                                     |   |   |       |   |   |   |
| 442 | Shapiro Wilk Test Statistic                                                      |   |   | 0.93   |   | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |   |       |   |   |   |
| 443 | 5% Shapiro Wilk Critical Value                                                   |   |   | 0.934  |   | Data Not Lognormal at 5% Significance Level         |   |   |       |   |   |   |
| 444 | Lilliefors Test Statistic                                                        |   |   | 0.148  |   | <b>Lilliefors Lognormal GOF Test</b>                |   |   |       |   |   |   |
| 445 | 5% Lilliefors Critical Value                                                     |   |   | 0.148  |   | Data appear Lognormal at 5% Significance Level      |   |   |       |   |   |   |
| 446 | <b>Data appear Approximate Lognormal at 5% Significance Level</b>                |   |   |        |   |                                                     |   |   |       |   |   |   |
| 447 |                                                                                  |   |   |        |   |                                                     |   |   |       |   |   |   |
| 448 | <b>Lognormal Statistics</b>                                                      |   |   |        |   |                                                     |   |   |       |   |   |   |
| 449 | Minimum of Logged Data                                                           |   |   | 9.729  |   | Mean of logged Data                                 |   |   | 10.19 |   |   |   |
| 450 | Maximum of Logged Data                                                           |   |   | 11.01  |   | SD of logged Data                                   |   |   | 0.316 |   |   |   |
| 451 |                                                                                  |   |   |        |   |                                                     |   |   |       |   |   |   |
| 452 | <b>Assuming Lognormal Distribution</b>                                           |   |   |        |   |                                                     |   |   |       |   |   |   |
| 453 | 95% H-UCL                                                                        |   |   | 30958  |   | 90% Chebyshev (MVUE) UCL                            |   |   | 32597 |   |   |   |
| 454 | 95% Chebyshev (MVUE) UCL                                                         |   |   | 34667  |   | 97.5% Chebyshev (MVUE) UCL                          |   |   | 37540 |   |   |   |
| 455 | 99% Chebyshev (MVUE) UCL                                                         |   |   | 43183  |   |                                                     |   |   |       |   |   |   |
| 456 |                                                                                  |   |   |        |   |                                                     |   |   |       |   |   |   |
| 457 | <b>Nonparametric Distribution Free UCL Statistics</b>                            |   |   |        |   |                                                     |   |   |       |   |   |   |
| 458 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b> |   |   |        |   |                                                     |   |   |       |   |   |   |
| 459 |                                                                                  |   |   |        |   |                                                     |   |   |       |   |   |   |
| 460 | <b>Nonparametric Distribution Free UCLs</b>                                      |   |   |        |   |                                                     |   |   |       |   |   |   |
| 461 | 95% CLT UCL                                                                      |   |   | 30980  |   | 95% Jackknife UCL                                   |   |   | 31059 |   |   |   |
| 462 | 95% Standard Bootstrap UCL                                                       |   |   | 30913  |   | 95% Bootstrap-t UCL                                 |   |   | 31940 |   |   |   |
| 463 | 95% Hall's Bootstrap UCL                                                         |   |   | 31969  |   | 95% Percentile Bootstrap UCL                        |   |   | 31054 |   |   |   |
| 464 | 95% BCA Bootstrap UCL                                                            |   |   | 31666  |   |                                                     |   |   |       |   |   |   |
| 465 | 90% Chebyshev(Mean, Sd) UCL                                                      |   |   | 33315  |   | 95% Chebyshev(Mean, Sd) UCL                         |   |   | 35656 |   |   |   |
| 466 | 97.5% Chebyshev(Mean, Sd) UCL                                                    |   |   | 38906  |   | 99% Chebyshev(Mean, Sd) UCL                         |   |   | 45290 |   |   |   |
| 467 |                                                                                  |   |   |        |   |                                                     |   |   |       |   |   |   |
| 468 | <b>Suggested UCL to Use</b>                                                      |   |   |        |   |                                                     |   |   |       |   |   |   |
| 469 | 95% Student's-t UCL                                                              |   |   | 31059  |   | or 95% Modified-t UCL                               |   |   | 31137 |   |   |   |

| A   | B                                                                                                                                        | C | D | E      | F                                                   | G | H | I     | J | K | L |  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------|---|---|-------|---|---|---|--|
| 470 | or 95% H-UCL                                                                                                                             |   |   | 30958  |                                                     |   |   |       |   |   |   |  |
| 471 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |  |
| 472 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                     |   |   |       |   |   |   |  |
| 473 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                     |   |   |       |   |   |   |  |
| 474 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                     |   |   |       |   |   |   |  |
| 475 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                     |   |   |       |   |   |   |  |
| 476 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |  |
| 477 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |   |   |        |                                                     |   |   |       |   |   |   |  |
| 478 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |   |   |        |                                                     |   |   |       |   |   |   |  |
| 479 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |   |   |        |                                                     |   |   |       |   |   |   |  |
| 480 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |   |   |        |                                                     |   |   |       |   |   |   |  |
| 481 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |  |
| 482 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |  |
| 483 | <b>Result (eu1_lead_roadway)</b>                                                                                                         |   |   |        |                                                     |   |   |       |   |   |   |  |
| 484 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |  |
| 485 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                     |   |   |       |   |   |   |  |
| 486 | Total Number of Observations                                                                                                             |   |   | 35     | Number of Distinct Observations                     |   |   | 33    |   |   |   |  |
| 487 |                                                                                                                                          |   |   |        | Number of Missing Observations                      |   |   | 0     |   |   |   |  |
| 488 | Minimum                                                                                                                                  |   |   | 35.4   | Mean                                                |   |   | 1200  |   |   |   |  |
| 489 | Maximum                                                                                                                                  |   |   | 10300  | Median                                              |   |   | 465   |   |   |   |  |
| 490 | SD                                                                                                                                       |   |   | 2115   | Std. Error of Mean                                  |   |   | 357.5 |   |   |   |  |
| 491 | Coefficient of Variation                                                                                                                 |   |   | 1.763  | Skewness                                            |   |   | 3.395 |   |   |   |  |
| 492 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |  |
| 493 | <b>Normal GOF Test</b>                                                                                                                   |   |   |        |                                                     |   |   |       |   |   |   |  |
| 494 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.528  | <b>Shapiro Wilk GOF Test</b>                        |   |   |       |   |   |   |  |
| 495 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.934  | Data Not Normal at 5% Significance Level            |   |   |       |   |   |   |  |
| 496 | Lilliefors Test Statistic                                                                                                                |   |   | 0.306  | <b>Lilliefors GOF Test</b>                          |   |   |       |   |   |   |  |
| 497 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.148  | Data Not Normal at 5% Significance Level            |   |   |       |   |   |   |  |
| 498 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |  |
| 499 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |  |
| 500 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |        |                                                     |   |   |       |   |   |   |  |
| 501 | <b>95% Normal UCL</b>                                                                                                                    |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>             |   |   |       |   |   |   |  |
| 502 | 95% Student's-t UCL                                                                                                                      |   |   | 1804   | 95% Adjusted-CLT UCL (Chen-1995)                    |   |   | 2007  |   |   |   |  |
| 503 |                                                                                                                                          |   |   |        | 95% Modified-t UCL (Johnson-1978)                   |   |   | 1839  |   |   |   |  |
| 504 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |  |
| 505 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |        |                                                     |   |   |       |   |   |   |  |
| 506 | A-D Test Statistic                                                                                                                       |   |   | 1.484  | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |       |   |   |   |  |
| 507 | 5% A-D Critical Value                                                                                                                    |   |   | 0.79   | Data Not Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |  |
| 508 | K-S Test Statistic                                                                                                                       |   |   | 0.186  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |       |   |   |   |  |
| 509 | 5% K-S Critical Value                                                                                                                    |   |   | 0.155  | Data Not Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |  |
| 510 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |   |        |                                                     |   |   |       |   |   |   |  |
| 511 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |  |
| 512 | <b>Gamma Statistics</b>                                                                                                                  |   |   |        |                                                     |   |   |       |   |   |   |  |
| 513 | k hat (MLE)                                                                                                                              |   |   | 0.728  | k star (bias corrected MLE)                         |   |   | 0.685 |   |   |   |  |
| 514 | Theta hat (MLE)                                                                                                                          |   |   | 1648   | Theta star (bias corrected MLE)                     |   |   | 1752  |   |   |   |  |
| 515 | nu hat (MLE)                                                                                                                             |   |   | 50.97  | nu star (bias corrected)                            |   |   | 47.93 |   |   |   |  |
| 516 | MLE Mean (bias corrected)                                                                                                                |   |   | 1200   | MLE Sd (bias corrected)                             |   |   | 1450  |   |   |   |  |
| 517 |                                                                                                                                          |   |   |        | Approximate Chi Square Value (0.05)                 |   |   | 33.04 |   |   |   |  |
| 518 | Adjusted Level of Significance                                                                                                           |   |   | 0.0425 | Adjusted Chi Square Value                           |   |   | 32.46 |   |   |   |  |
| 519 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |  |
| 520 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |        |                                                     |   |   |       |   |   |   |  |
| 521 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |   | 1741   | 95% Adjusted Gamma UCL (use when n<50)              |   |   | 1772  |   |   |   |  |
| 522 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |  |
| 523 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |        |                                                     |   |   |       |   |   |   |  |
| 524 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.979  | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |   |       |   |   |   |  |
| 525 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.934  | Data appear Lognormal at 5% Significance Level      |   |   |       |   |   |   |  |
| 526 | Lilliefors Test Statistic                                                                                                                |   |   | 0.0933 | <b>Lilliefors Lognormal GOF Test</b>                |   |   |       |   |   |   |  |
| 527 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.148  | Data appear Lognormal at 5% Significance Level      |   |   |       |   |   |   |  |
| 528 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |        |                                                     |   |   |       |   |   |   |  |
| 529 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |  |
| 530 | <b>Lognormal Statistics</b>                                                                                                              |   |   |        |                                                     |   |   |       |   |   |   |  |
| 531 | Minimum of Logged Data                                                                                                                   |   |   | 3.567  | Mean of logged Data                                 |   |   | 6.264 |   |   |   |  |
| 532 | Maximum of Logged Data                                                                                                                   |   |   | 9.24   | SD of logged Data                                   |   |   | 1.255 |   |   |   |  |
| 533 |                                                                                                                                          |   |   |        |                                                     |   |   |       |   |   |   |  |
| 534 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |        |                                                     |   |   |       |   |   |   |  |
| 535 | 95% H-UCL                                                                                                                                |   |   | 2103   | 90% Chebyshev (MVUE) UCL                            |   |   | 1977  |   |   |   |  |
| 536 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 2369   | 97.5% Chebyshev (MVUE) UCL                          |   |   | 2913  |   |   |   |  |

| A   | B                                                                                                                                        | C | D      | E | F                                       | G | H | I                                                   | J | K     | L |  |  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|---|-----------------------------------------|---|---|-----------------------------------------------------|---|-------|---|--|--|
| 537 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |        |   | 3982                                    |   |   |                                                     |   |       |   |  |  |
| 538 |                                                                                                                                          |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 539 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 540 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 541 |                                                                                                                                          |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 542 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 543 | 95% CLT UCL                                                                                                                              |   | 1788   |   |                                         |   |   | 95% Jackknife UCL                                   |   | 1804  |   |  |  |
| 544 | 95% Standard Bootstrap UCL                                                                                                               |   | 1777   |   |                                         |   |   | 95% Bootstrap-t UCL                                 |   | 2611  |   |  |  |
| 545 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 4355   |   |                                         |   |   | 95% Percentile Bootstrap UCL                        |   | 1886  |   |  |  |
| 546 | 95% BCA Bootstrap UCL                                                                                                                    |   | 2067   |   |                                         |   |   |                                                     |   |       |   |  |  |
| 547 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 2272   |   |                                         |   |   | 95% Chebyshev(Mean, Sd) UCL                         |   | 2758  |   |  |  |
| 548 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 3432   |   |                                         |   |   | 99% Chebyshev(Mean, Sd) UCL                         |   | 4757  |   |  |  |
| 549 |                                                                                                                                          |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 550 | <b>Suggested UCL to Use</b>                                                                                                              |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 551 | 95% H-UCL                                                                                                                                |   | 2103   |   |                                         |   |   |                                                     |   |       |   |  |  |
| 552 |                                                                                                                                          |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 553 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 554 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 555 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 556 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 557 |                                                                                                                                          |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 558 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 559 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 560 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 561 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 562 |                                                                                                                                          |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 563 |                                                                                                                                          |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 564 | <b>Result (eu1_manganese_roadway)</b>                                                                                                    |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 565 |                                                                                                                                          |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 566 | <b>General Statistics</b>                                                                                                                |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 567 | Total Number of Observations                                                                                                             |   | 35     |   |                                         |   |   | Number of Distinct Observations                     |   | 33    |   |  |  |
| 568 |                                                                                                                                          |   |        |   |                                         |   |   | Number of Missing Observations                      |   | 0     |   |  |  |
| 569 | Minimum                                                                                                                                  |   | 237    |   |                                         |   |   | Mean                                                |   | 3308  |   |  |  |
| 570 | Maximum                                                                                                                                  |   | 27800  |   |                                         |   |   | Median                                              |   | 1550  |   |  |  |
| 571 | SD                                                                                                                                       |   | 6095   |   |                                         |   |   | Std. Error of Mean                                  |   | 1030  |   |  |  |
| 572 | Coefficient of Variation                                                                                                                 |   | 1.842  |   |                                         |   |   | Skewness                                            |   | 3.735 |   |  |  |
| 573 |                                                                                                                                          |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 574 | <b>Normal GOF Test</b>                                                                                                                   |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 575 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.417  |   |                                         |   |   | <b>Shapiro Wilk GOF Test</b>                        |   |       |   |  |  |
| 576 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.934  |   |                                         |   |   | Data Not Normal at 5% Significance Level            |   |       |   |  |  |
| 577 | Lilliefors Test Statistic                                                                                                                |   | 0.359  |   |                                         |   |   | <b>Lilliefors GOF Test</b>                          |   |       |   |  |  |
| 578 | 5% Lilliefors Critical Value                                                                                                             |   | 0.148  |   |                                         |   |   | Data Not Normal at 5% Significance Level            |   |       |   |  |  |
| 579 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 580 |                                                                                                                                          |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 581 | <b>Assuming Normal Distribution</b>                                                                                                      |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 582 | <b>95% Normal UCL</b>                                                                                                                    |   |        |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |   |                                                     |   |       |   |  |  |
| 583 | 95% Student's-t UCL                                                                                                                      |   | 5050   |   |                                         |   |   | 95% Adjusted-CLT UCL (Chen-1995)                    |   | 5698  |   |  |  |
| 584 |                                                                                                                                          |   |        |   |                                         |   |   | 95% Modified-t UCL (Johnson-1978)                   |   | 5159  |   |  |  |
| 585 |                                                                                                                                          |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 586 | <b>Gamma GOF Test</b>                                                                                                                    |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 587 | A-D Test Statistic                                                                                                                       |   | 3.484  |   |                                         |   |   | <b>Anderson-Darling Gamma GOF Test</b>              |   |       |   |  |  |
| 588 | 5% A-D Critical Value                                                                                                                    |   | 0.778  |   |                                         |   |   | Data Not Gamma Distributed at 5% Significance Level |   |       |   |  |  |
| 589 | K-S Test Statistic                                                                                                                       |   | 0.248  |   |                                         |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |       |   |  |  |
| 590 | 5% K-S Critical Value                                                                                                                    |   | 0.153  |   |                                         |   |   | Data Not Gamma Distributed at 5% Significance Level |   |       |   |  |  |
| 591 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 592 |                                                                                                                                          |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 593 | <b>Gamma Statistics</b>                                                                                                                  |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 594 | k hat (MLE)                                                                                                                              |   | 0.953  |   |                                         |   |   | k star (bias corrected MLE)                         |   | 0.89  |   |  |  |
| 595 | Theta hat (MLE)                                                                                                                          |   | 3472   |   |                                         |   |   | Theta star (bias corrected MLE)                     |   | 3716  |   |  |  |
| 596 | nu hat (MLE)                                                                                                                             |   | 66.7   |   |                                         |   |   | nu star (bias corrected)                            |   | 62.32 |   |  |  |
| 597 | MLE Mean (bias corrected)                                                                                                                |   | 3308   |   |                                         |   |   | MLE Sd (bias corrected)                             |   | 3506  |   |  |  |
| 598 |                                                                                                                                          |   |        |   |                                         |   |   | Approximate Chi Square Value (0.05)                 |   | 45.16 |   |  |  |
| 599 | Adjusted Level of Significance                                                                                                           |   | 0.0425 |   |                                         |   |   | Adjusted Chi Square Value                           |   | 44.47 |   |  |  |
| 600 |                                                                                                                                          |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 601 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |
| 602 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   | 4565   |   |                                         |   |   | 95% Adjusted Gamma UCL (use when n<50)              |   | 4637  |   |  |  |
| 603 |                                                                                                                                          |   |        |   |                                         |   |   |                                                     |   |       |   |  |  |

| A   | B                                                                                                                                        | C | D     | E | G                                                   | H | I | J | K     | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|-------|---|-----------------------------------------------------|---|---|---|-------|---|
| 604 | <b>Lognormal GOF Test</b>                                                                                                                |   |       |   |                                                     |   |   |   |       |   |
| 605 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.894 |   | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |   |   |       |   |
| 606 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.934 |   | Data Not Lognormal at 5% Significance Level         |   |   |   |       |   |
| 607 | Lilliefors Test Statistic                                                                                                                |   | 0.149 |   | <b>Lilliefors Lognormal GOF Test</b>                |   |   |   |       |   |
| 608 | 5% Lilliefors Critical Value                                                                                                             |   | 0.148 |   | Data Not Lognormal at 5% Significance Level         |   |   |   |       |   |
| 609 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |   |       |   |                                                     |   |   |   |       |   |
| 610 |                                                                                                                                          |   |       |   |                                                     |   |   |   |       |   |
| 611 | <b>Lognormal Statistics</b>                                                                                                              |   |       |   |                                                     |   |   |   |       |   |
| 612 | Minimum of Logged Data                                                                                                                   |   | 5.468 |   | Mean of logged Data                                 |   |   |   | 7.495 |   |
| 613 | Maximum of Logged Data                                                                                                                   |   | 10.23 |   | SD of logged Data                                   |   |   |   | 0.928 |   |
| 614 |                                                                                                                                          |   |       |   |                                                     |   |   |   |       |   |
| 615 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |       |   |                                                     |   |   |   |       |   |
| 616 | 95% H-UCL                                                                                                                                |   | 4034  |   | 90% Chebyshev (MVUE) UCL                            |   |   |   | 4178  |   |
| 617 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 4839  |   | 97.5% Chebyshev (MVUE) UCL                          |   |   |   | 5755  |   |
| 618 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 7556  |   |                                                     |   |   |   |       |   |
| 619 |                                                                                                                                          |   |       |   |                                                     |   |   |   |       |   |
| 620 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |       |   |                                                     |   |   |   |       |   |
| 621 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |   |       |   |                                                     |   |   |   |       |   |
| 622 |                                                                                                                                          |   |       |   |                                                     |   |   |   |       |   |
| 623 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |       |   |                                                     |   |   |   |       |   |
| 624 | 95% CLT UCL                                                                                                                              |   | 5003  |   | 95% Jackknife UCL                                   |   |   |   | 5050  |   |
| 625 | 95% Standard Bootstrap UCL                                                                                                               |   | 4957  |   | 95% Bootstrap-t UCL                                 |   |   |   | 10859 |   |
| 626 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 13416 |   | 95% Percentile Bootstrap UCL                        |   |   |   | 5153  |   |
| 627 | 95% BCA Bootstrap UCL                                                                                                                    |   | 5756  |   |                                                     |   |   |   |       |   |
| 628 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 6399  |   | 95% Chebyshev(Mean, Sd) UCL                         |   |   |   | 7799  |   |
| 629 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 9742  |   | 99% Chebyshev(Mean, Sd) UCL                         |   |   |   | 13559 |   |
| 630 |                                                                                                                                          |   |       |   |                                                     |   |   |   |       |   |
| 631 | <b>Suggested UCL to Use</b>                                                                                                              |   |       |   |                                                     |   |   |   |       |   |
| 632 | 95% Chebyshev (Mean, Sd) UCL                                                                                                             |   | 7799  |   |                                                     |   |   |   |       |   |
| 633 |                                                                                                                                          |   |       |   |                                                     |   |   |   |       |   |
| 634 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |       |   |                                                     |   |   |   |       |   |
| 635 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |       |   |                                                     |   |   |   |       |   |
| 636 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |       |   |                                                     |   |   |   |       |   |
| 637 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |       |   |                                                     |   |   |   |       |   |
| 638 |                                                                                                                                          |   |       |   |                                                     |   |   |   |       |   |
| 639 |                                                                                                                                          |   |       |   |                                                     |   |   |   |       |   |
| 640 | <b>Result (eu1_thallium_roadway)</b>                                                                                                     |   |       |   |                                                     |   |   |   |       |   |
| 641 |                                                                                                                                          |   |       |   |                                                     |   |   |   |       |   |
| 642 | <b>General Statistics</b>                                                                                                                |   |       |   |                                                     |   |   |   |       |   |
| 643 | Total Number of Observations                                                                                                             |   | 35    |   | Number of Distinct Observations                     |   |   |   | 25    |   |
| 644 |                                                                                                                                          |   |       |   | Number of Missing Observations                      |   |   |   | 0     |   |
| 645 | Minimum                                                                                                                                  |   | 0.055 |   | Mean                                                |   |   |   | 0.634 |   |
| 646 | Maximum                                                                                                                                  |   | 2.8   |   | Median                                              |   |   |   | 0.36  |   |
| 647 | SD                                                                                                                                       |   | 0.729 |   | Std. Error of Mean                                  |   |   |   | 0.123 |   |
| 648 | Coefficient of Variation                                                                                                                 |   | 1.15  |   | Skewness                                            |   |   |   | 1.988 |   |
| 649 |                                                                                                                                          |   |       |   |                                                     |   |   |   |       |   |
| 650 | <b>Normal GOF Test</b>                                                                                                                   |   |       |   |                                                     |   |   |   |       |   |
| 651 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.695 |   | <b>Shapiro Wilk GOF Test</b>                        |   |   |   |       |   |
| 652 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.934 |   | Data Not Normal at 5% Significance Level            |   |   |   |       |   |
| 653 | Lilliefors Test Statistic                                                                                                                |   | 0.305 |   | <b>Lilliefors GOF Test</b>                          |   |   |   |       |   |
| 654 | 5% Lilliefors Critical Value                                                                                                             |   | 0.148 |   | Data Not Normal at 5% Significance Level            |   |   |   |       |   |
| 655 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |       |   |                                                     |   |   |   |       |   |
| 656 |                                                                                                                                          |   |       |   |                                                     |   |   |   |       |   |
| 657 | <b>Assuming Normal Distribution</b>                                                                                                      |   |       |   |                                                     |   |   |   |       |   |
| 658 | <b>95% Normal UCL</b>                                                                                                                    |   |       |   | <b>95% UCLs (Adjusted for Skewness)</b>             |   |   |   |       |   |
| 659 | 95% Student's-t UCL                                                                                                                      |   | 0.843 |   | 95% Adjusted-CLT UCL (Chen-1995)                    |   |   |   | 0.881 |   |
| 660 |                                                                                                                                          |   |       |   | 95% Modified-t UCL (Johnson-1978)                   |   |   |   | 0.85  |   |
| 661 |                                                                                                                                          |   |       |   |                                                     |   |   |   |       |   |
| 662 | <b>Gamma GOF Test</b>                                                                                                                    |   |       |   |                                                     |   |   |   |       |   |
| 663 | A-D Test Statistic                                                                                                                       |   | 1.353 |   | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |   |       |   |
| 664 | 5% A-D Critical Value                                                                                                                    |   | 0.773 |   | Data Not Gamma Distributed at 5% Significance Level |   |   |   |       |   |
| 665 | K-S Test Statistic                                                                                                                       |   | 0.198 |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |   |       |   |
| 666 | 5% K-S Critical Value                                                                                                                    |   | 0.153 |   | Data Not Gamma Distributed at 5% Significance Level |   |   |   |       |   |
| 667 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |       |   |                                                     |   |   |   |       |   |
| 668 |                                                                                                                                          |   |       |   |                                                     |   |   |   |       |   |
| 669 | <b>Gamma Statistics</b>                                                                                                                  |   |       |   |                                                     |   |   |   |       |   |
| 670 | k hat (MLE)                                                                                                                              |   | 1.154 |   | k star (bias corrected MLE)                         |   |   |   | 1.074 |   |

|     | A                                                                                                                                        | B | C | D                                           | E | F      | G | H | I                                              | J | K | L      |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---|---------------------------------------------|---|--------|---|---|------------------------------------------------|---|---|--------|
| 671 |                                                                                                                                          |   |   | Theta hat (MLE)                             |   | 0.55   |   |   | Theta star (bias corrected MLE)                |   |   | 0.59   |
| 672 |                                                                                                                                          |   |   | nu hat (MLE)                                |   | 80.77  |   |   | nu star (bias corrected)                       |   |   | 75.18  |
| 673 |                                                                                                                                          |   |   | MLE Mean (bias corrected)                   |   | 0.634  |   |   | MLE Sd (bias corrected)                        |   |   | 0.612  |
| 674 |                                                                                                                                          |   |   |                                             |   |        |   |   | Approximate Chi Square Value (0.05)            |   |   | 56.21  |
| 675 |                                                                                                                                          |   |   | Adjusted Level of Significance              |   | 0.0425 |   |   | Adjusted Chi Square Value                      |   |   | 55.43  |
| 676 |                                                                                                                                          |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 677 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 678 |                                                                                                                                          |   |   | 95% Approximate Gamma UCL (use when n>=50)) |   | 0.848  |   |   | 95% Adjusted Gamma UCL (use when n<50)         |   |   | 0.86   |
| 679 |                                                                                                                                          |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 680 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 681 |                                                                                                                                          |   |   | Shapiro Wilk Test Statistic                 |   | 0.959  |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>         |   |   |        |
| 682 |                                                                                                                                          |   |   | 5% Shapiro Wilk Critical Value              |   | 0.934  |   |   | Data appear Lognormal at 5% Significance Level |   |   |        |
| 683 |                                                                                                                                          |   |   | Lilliefors Test Statistic                   |   | 0.125  |   |   | <b>Lilliefors Lognormal GOF Test</b>           |   |   |        |
| 684 |                                                                                                                                          |   |   | 5% Lilliefors Critical Value                |   | 0.148  |   |   | Data appear Lognormal at 5% Significance Level |   |   |        |
| 685 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 686 |                                                                                                                                          |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 687 | <b>Lognormal Statistics</b>                                                                                                              |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 688 |                                                                                                                                          |   |   | Minimum of Logged Data                      |   | -2.9   |   |   | Mean of logged Data                            |   |   | -0.948 |
| 689 |                                                                                                                                          |   |   | Maximum of Logged Data                      |   | 1.03   |   |   | SD of logged Data                              |   |   | 0.983  |
| 690 |                                                                                                                                          |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 691 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 692 |                                                                                                                                          |   |   | 95% H-UCL                                   |   | 0.948  |   |   | 90% Chebyshev (MVUE) UCL                       |   |   | 0.971  |
| 693 |                                                                                                                                          |   |   | 95% Chebyshev (MVUE) UCL                    |   | 1.131  |   |   | 97.5% Chebyshev (MVUE) UCL                     |   |   | 1.354  |
| 694 |                                                                                                                                          |   |   | 99% Chebyshev (MVUE) UCL                    |   | 1.792  |   |   |                                                |   |   |        |
| 695 |                                                                                                                                          |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 696 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 697 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 698 |                                                                                                                                          |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 699 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 700 |                                                                                                                                          |   |   | 95% CLT UCL                                 |   | 0.837  |   |   | 95% Jackknife UCL                              |   |   | 0.843  |
| 701 |                                                                                                                                          |   |   | 95% Standard Bootstrap UCL                  |   | 0.834  |   |   | 95% Bootstrap-t UCL                            |   |   | 0.928  |
| 702 |                                                                                                                                          |   |   | 95% Hall's Bootstrap UCL                    |   | 0.871  |   |   | 95% Percentile Bootstrap UCL                   |   |   | 0.855  |
| 703 |                                                                                                                                          |   |   | 95% BCA Bootstrap UCL                       |   | 0.892  |   |   |                                                |   |   |        |
| 704 |                                                                                                                                          |   |   | 90% Chebyshev(Mean, Sd) UCL                 |   | 1.004  |   |   | 95% Chebyshev(Mean, Sd) UCL                    |   |   | 1.172  |
| 705 |                                                                                                                                          |   |   | 97.5% Chebyshev(Mean, Sd) UCL               |   | 1.404  |   |   | 99% Chebyshev(Mean, Sd) UCL                    |   |   | 1.861  |
| 706 |                                                                                                                                          |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 707 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 708 |                                                                                                                                          |   |   | 95% H-UCL                                   |   | 0.948  |   |   |                                                |   |   |        |
| 709 |                                                                                                                                          |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 710 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 711 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 712 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 713 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 714 |                                                                                                                                          |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 715 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 716 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 717 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 718 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 719 |                                                                                                                                          |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 720 |                                                                                                                                          |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 721 | <b>Result (eu1_zinc_roadway)</b>                                                                                                         |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 722 |                                                                                                                                          |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 723 | <b>General Statistics</b>                                                                                                                |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 724 |                                                                                                                                          |   |   | Total Number of Observations                |   | 35     |   |   | Number of Distinct Observations                |   |   | 35     |
| 725 |                                                                                                                                          |   |   |                                             |   |        |   |   | Number of Missing Observations                 |   |   | 0      |
| 726 |                                                                                                                                          |   |   | Minimum                                     |   | 92.8   |   |   | Mean                                           |   |   | 810.1  |
| 727 |                                                                                                                                          |   |   | Maximum                                     |   | 6270   |   |   | Median                                         |   |   | 622    |
| 728 |                                                                                                                                          |   |   | SD                                          |   | 1039   |   |   | Std. Error of Mean                             |   |   | 175.7  |
| 729 |                                                                                                                                          |   |   | Coefficient of Variation                    |   | 1.283  |   |   | Skewness                                       |   |   | 4.477  |
| 730 |                                                                                                                                          |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 731 | <b>Normal GOF Test</b>                                                                                                                   |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 732 |                                                                                                                                          |   |   | Shapiro Wilk Test Statistic                 |   | 0.537  |   |   | <b>Shapiro Wilk GOF Test</b>                   |   |   |        |
| 733 |                                                                                                                                          |   |   | 5% Shapiro Wilk Critical Value              |   | 0.934  |   |   | Data Not Normal at 5% Significance Level       |   |   |        |
| 734 |                                                                                                                                          |   |   | Lilliefors Test Statistic                   |   | 0.245  |   |   | <b>Lilliefors GOF Test</b>                     |   |   |        |
| 735 |                                                                                                                                          |   |   | 5% Lilliefors Critical Value                |   | 0.148  |   |   | Data Not Normal at 5% Significance Level       |   |   |        |
| 736 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |                                             |   |        |   |   |                                                |   |   |        |
| 737 |                                                                                                                                          |   |   |                                             |   |        |   |   |                                                |   |   |        |

| A   | B                                                                                                                                       | C | D | E      | F | G                                                             | H | I | J | K     | L |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|---|---------------------------------------------------------------|---|---|---|-------|---|
| 738 | <b>Assuming Normal Distribution</b>                                                                                                     |   |   |        |   |                                                               |   |   |   |       |   |
| 739 | <b>95% Normal UCL</b>                                                                                                                   |   |   |        |   | <b>95% UCLs (Adjusted for Skewness)</b>                       |   |   |   |       |   |
| 740 | 95% Student's-t UCL                                                                                                                     |   |   | 1107   |   | 95% Adjusted-CLT UCL (Chen-1995)                              |   |   |   | 1241  |   |
| 741 |                                                                                                                                         |   |   |        |   | 95% Modified-t UCL (Johnson-1978)                             |   |   |   | 1129  |   |
| 742 |                                                                                                                                         |   |   |        |   |                                                               |   |   |   |       |   |
| 743 | <b>Gamma GOF Test</b>                                                                                                                   |   |   |        |   |                                                               |   |   |   |       |   |
| 744 | A-D Test Statistic                                                                                                                      |   |   | 0.607  |   | <b>Anderson-Darling Gamma GOF Test</b>                        |   |   |   |       |   |
| 745 | 5% A-D Critical Value                                                                                                                   |   |   | 0.77   |   | Detected data appear Gamma Distributed at 5% Significance Lev |   |   |   |       |   |
| 746 | K-S Test Statistic                                                                                                                      |   |   | 0.101  |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                      |   |   |   |       |   |
| 747 | 5% K-S Critical Value                                                                                                                   |   |   | 0.152  |   | Detected data appear Gamma Distributed at 5% Significance Lev |   |   |   |       |   |
| 748 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                  |   |   |        |   |                                                               |   |   |   |       |   |
| 749 |                                                                                                                                         |   |   |        |   |                                                               |   |   |   |       |   |
| 750 | <b>Gamma Statistics</b>                                                                                                                 |   |   |        |   |                                                               |   |   |   |       |   |
| 751 | k hat (MLE)                                                                                                                             |   |   | 1.328  |   | k star (bias corrected MLE)                                   |   |   |   | 1.233 |   |
| 752 | Theta hat (MLE)                                                                                                                         |   |   | 610    |   | Theta star (bias corrected MLE)                               |   |   |   | 656.9 |   |
| 753 | nu hat (MLE)                                                                                                                            |   |   | 92.97  |   | nu star (bias corrected)                                      |   |   |   | 86.33 |   |
| 754 | MLE Mean (bias corrected)                                                                                                               |   |   | 810.1  |   | MLE Sd (bias corrected)                                       |   |   |   | 729.5 |   |
| 755 |                                                                                                                                         |   |   |        |   | Approximate Chi Square Value (0.05)                           |   |   |   | 65.91 |   |
| 756 | Adjusted Level of Significance                                                                                                          |   |   | 0.0425 |   | Adjusted Chi Square Value                                     |   |   |   | 65.07 |   |
| 757 |                                                                                                                                         |   |   |        |   |                                                               |   |   |   |       |   |
| 758 | <b>Assuming Gamma Distribution</b>                                                                                                      |   |   |        |   |                                                               |   |   |   |       |   |
| 759 | 95% Approximate Gamma UCL (use when n>=50)                                                                                              |   |   | 1061   |   | 95% Adjusted Gamma UCL (use when n<50)                        |   |   |   | 1075  |   |
| 760 |                                                                                                                                         |   |   |        |   |                                                               |   |   |   |       |   |
| 761 | <b>Lognormal GOF Test</b>                                                                                                               |   |   |        |   |                                                               |   |   |   |       |   |
| 762 | Shapiro Wilk Test Statistic                                                                                                             |   |   | 0.955  |   | <b>Shapiro Wilk Lognormal GOF Test</b>                        |   |   |   |       |   |
| 763 | 5% Shapiro Wilk Critical Value                                                                                                          |   |   | 0.934  |   | Data appear Lognormal at 5% Significance Level                |   |   |   |       |   |
| 764 | Lilliefors Test Statistic                                                                                                               |   |   | 0.0886 |   | <b>Lilliefors Lognormal GOF Test</b>                          |   |   |   |       |   |
| 765 | 5% Lilliefors Critical Value                                                                                                            |   |   | 0.148  |   | Data appear Lognormal at 5% Significance Level                |   |   |   |       |   |
| 766 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                   |   |   |        |   |                                                               |   |   |   |       |   |
| 767 |                                                                                                                                         |   |   |        |   |                                                               |   |   |   |       |   |
| 768 | <b>Lognormal Statistics</b>                                                                                                             |   |   |        |   |                                                               |   |   |   |       |   |
| 769 | Minimum of Logged Data                                                                                                                  |   |   | 4.53   |   | Mean of logged Data                                           |   |   |   | 6.276 |   |
| 770 | Maximum of Logged Data                                                                                                                  |   |   | 8.744  |   | SD of logged Data                                             |   |   |   | 0.923 |   |
| 771 |                                                                                                                                         |   |   |        |   |                                                               |   |   |   |       |   |
| 772 | <b>Assuming Lognormal Distribution</b>                                                                                                  |   |   |        |   |                                                               |   |   |   |       |   |
| 773 | 95% H-UCL                                                                                                                               |   |   | 1184   |   | 90% Chebyshev (MVUE) UCL                                      |   |   |   | 1227  |   |
| 774 | 95% Chebyshev (MVUE) UCL                                                                                                                |   |   | 1421   |   | 97.5% Chebyshev (MVUE) UCL                                    |   |   |   | 1689  |   |
| 775 | 99% Chebyshev (MVUE) UCL                                                                                                                |   |   | 2216   |   |                                                               |   |   |   |       |   |
| 776 |                                                                                                                                         |   |   |        |   |                                                               |   |   |   |       |   |
| 777 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                   |   |   |        |   |                                                               |   |   |   |       |   |
| 778 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                        |   |   |        |   |                                                               |   |   |   |       |   |
| 779 |                                                                                                                                         |   |   |        |   |                                                               |   |   |   |       |   |
| 780 | <b>Nonparametric Distribution Free UCLs</b>                                                                                             |   |   |        |   |                                                               |   |   |   |       |   |
| 781 | 95% CLT UCL                                                                                                                             |   |   | 1099   |   | 95% Jackknife UCL                                             |   |   |   | 1107  |   |
| 782 | 95% Standard Bootstrap UCL                                                                                                              |   |   | 1093   |   | 95% Bootstrap-t UCL                                           |   |   |   | 1460  |   |
| 783 | 95% Hall's Bootstrap UCL                                                                                                                |   |   | 2297   |   | 95% Percentile Bootstrap UCL                                  |   |   |   | 1124  |   |
| 784 | 95% BCA Bootstrap UCL                                                                                                                   |   |   | 1320   |   |                                                               |   |   |   |       |   |
| 785 | 90% Chebyshev(Mean, Sd) UCL                                                                                                             |   |   | 1337   |   | 95% Chebyshev(Mean, Sd) UCL                                   |   |   |   | 1576  |   |
| 786 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                           |   |   | 1907   |   | 99% Chebyshev(Mean, Sd) UCL                                   |   |   |   | 2558  |   |
| 787 |                                                                                                                                         |   |   |        |   |                                                               |   |   |   |       |   |
| 788 | <b>Suggested UCL to Use</b>                                                                                                             |   |   |        |   |                                                               |   |   |   |       |   |
| 789 | 95% Adjusted Gamma UCL                                                                                                                  |   |   | 1075   |   |                                                               |   |   |   |       |   |
| 790 |                                                                                                                                         |   |   |        |   |                                                               |   |   |   |       |   |
| 791 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.            |   |   |        |   |                                                               |   |   |   |       |   |
| 792 | Recommendations are based upon data size, data distribution, and skewness.                                                              |   |   |        |   |                                                               |   |   |   |       |   |
| 793 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                |   |   |        |   |                                                               |   |   |   |       |   |
| 794 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statisticia |   |   |        |   |                                                               |   |   |   |       |   |
| 795 |                                                                                                                                         |   |   |        |   |                                                               |   |   |   |       |   |
| 796 |                                                                                                                                         |   |   |        |   |                                                               |   |   |   |       |   |
| 797 | <b>Result (eu2_antimony_roadway)</b>                                                                                                    |   |   |        |   |                                                               |   |   |   |       |   |
| 798 |                                                                                                                                         |   |   |        |   |                                                               |   |   |   |       |   |
| 799 | <b>General Statistics</b>                                                                                                               |   |   |        |   |                                                               |   |   |   |       |   |
| 800 | Total Number of Observations                                                                                                            |   |   | 34     |   | Number of Distinct Observations                               |   |   |   | 32    |   |
| 801 |                                                                                                                                         |   |   |        |   | Number of Missing Observations                                |   |   |   | 0     |   |
| 802 | Minimum                                                                                                                                 |   |   | 0.35   |   | Mean                                                          |   |   |   | 1.862 |   |
| 803 | Maximum                                                                                                                                 |   |   | 10.4   |   | Median                                                        |   |   |   | 0.814 |   |
| 804 | SD                                                                                                                                      |   |   | 2.566  |   | Std. Error of Mean                                            |   |   |   | 0.44  |   |



| A   | B                                                                                | C      | D | E | F | G | H                                                               | I     | J | K | L |
|-----|----------------------------------------------------------------------------------|--------|---|---|---|---|-----------------------------------------------------------------|-------|---|---|---|
| 872 |                                                                                  |        |   |   |   |   |                                                                 |       |   |   |   |
| 873 | Result (eu2_arsenic_roadway)                                                     |        |   |   |   |   |                                                                 |       |   |   |   |
| 874 |                                                                                  |        |   |   |   |   |                                                                 |       |   |   |   |
| 875 | <b>General Statistics</b>                                                        |        |   |   |   |   |                                                                 |       |   |   |   |
| 876 | Total Number of Observations                                                     | 34     |   |   |   |   | Number of Distinct Observations                                 | 34    |   |   |   |
| 877 |                                                                                  |        |   |   |   |   | Number of Missing Observations                                  | 0     |   |   |   |
| 878 | Minimum                                                                          | 3.19   |   |   |   |   | Mean                                                            | 25.93 |   |   |   |
| 879 | Maximum                                                                          | 106    |   |   |   |   | Median                                                          | 18.9  |   |   |   |
| 880 | SD                                                                               | 25.64  |   |   |   |   | Std. Error of Mean                                              | 4.397 |   |   |   |
| 881 | Coefficient of Variation                                                         | 0.989  |   |   |   |   | Skewness                                                        | 1.948 |   |   |   |
| 882 |                                                                                  |        |   |   |   |   |                                                                 |       |   |   |   |
| 883 | <b>Normal GOF Test</b>                                                           |        |   |   |   |   |                                                                 |       |   |   |   |
| 884 | Shapiro Wilk Test Statistic                                                      | 0.758  |   |   |   |   | <b>Shapiro Wilk GOF Test</b>                                    |       |   |   |   |
| 885 | 5% Shapiro Wilk Critical Value                                                   | 0.933  |   |   |   |   | Data Not Normal at 5% Significance Level                        |       |   |   |   |
| 886 | Lilliefors Test Statistic                                                        | 0.222  |   |   |   |   | <b>Lilliefors GOF Test</b>                                      |       |   |   |   |
| 887 | 5% Lilliefors Critical Value                                                     | 0.15   |   |   |   |   | Data Not Normal at 5% Significance Level                        |       |   |   |   |
| 888 | <b>Data Not Normal at 5% Significance Level</b>                                  |        |   |   |   |   |                                                                 |       |   |   |   |
| 889 |                                                                                  |        |   |   |   |   |                                                                 |       |   |   |   |
| 890 | <b>Assuming Normal Distribution</b>                                              |        |   |   |   |   |                                                                 |       |   |   |   |
| 891 | <b>95% Normal UCL</b>                                                            |        |   |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b>                         |       |   |   |   |
| 892 | 95% Student's-t UCL                                                              | 33.37  |   |   |   |   | 95% Adjusted-CLT UCL (Chen-1995)                                | 34.73 |   |   |   |
| 893 |                                                                                  |        |   |   |   |   | 95% Modified-t UCL (Johnson-1978)                               | 33.61 |   |   |   |
| 894 |                                                                                  |        |   |   |   |   |                                                                 |       |   |   |   |
| 895 | <b>Gamma GOF Test</b>                                                            |        |   |   |   |   |                                                                 |       |   |   |   |
| 896 | A-D Test Statistic                                                               | 0.584  |   |   |   |   | <b>Anderson-Darling Gamma GOF Test</b>                          |       |   |   |   |
| 897 | 5% A-D Critical Value                                                            | 0.768  |   |   |   |   | Detected data appear Gamma Distributed at 5% Significance Level |       |   |   |   |
| 898 | K-S Test Statistic                                                               | 0.108  |   |   |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |       |   |   |   |
| 899 | 5% K-S Critical Value                                                            | 0.154  |   |   |   |   | Detected data appear Gamma Distributed at 5% Significance Level |       |   |   |   |
| 900 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>           |        |   |   |   |   |                                                                 |       |   |   |   |
| 901 |                                                                                  |        |   |   |   |   |                                                                 |       |   |   |   |
| 902 | <b>Gamma Statistics</b>                                                          |        |   |   |   |   |                                                                 |       |   |   |   |
| 903 | k hat (MLE)                                                                      | 1.408  |   |   |   |   | k star (bias corrected MLE)                                     | 1.303 |   |   |   |
| 904 | Theta hat (MLE)                                                                  | 18.42  |   |   |   |   | Theta star (bias corrected MLE)                                 | 19.89 |   |   |   |
| 905 | nu hat (MLE)                                                                     | 95.73  |   |   |   |   | nu star (bias corrected)                                        | 88.62 |   |   |   |
| 906 | MLE Mean (bias corrected)                                                        | 25.93  |   |   |   |   | MLE Sd (bias corrected)                                         | 22.71 |   |   |   |
| 907 |                                                                                  |        |   |   |   |   | Approximate Chi Square Value (0.05)                             | 67.92 |   |   |   |
| 908 | Adjusted Level of Significance                                                   | 0.0422 |   |   |   |   | Adjusted Chi Square Value                                       | 67.02 |   |   |   |
| 909 |                                                                                  |        |   |   |   |   |                                                                 |       |   |   |   |
| 910 | <b>Assuming Gamma Distribution</b>                                               |        |   |   |   |   |                                                                 |       |   |   |   |
| 911 | 95% Approximate Gamma UCL (use when n>=50)                                       | 33.83  |   |   |   |   | 95% Adjusted Gamma UCL (use when n<50)                          | 34.28 |   |   |   |
| 912 |                                                                                  |        |   |   |   |   |                                                                 |       |   |   |   |
| 913 | <b>Lognormal GOF Test</b>                                                        |        |   |   |   |   |                                                                 |       |   |   |   |
| 914 | Shapiro Wilk Test Statistic                                                      | 0.974  |   |   |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |       |   |   |   |
| 915 | 5% Shapiro Wilk Critical Value                                                   | 0.933  |   |   |   |   | Data appear Lognormal at 5% Significance Level                  |       |   |   |   |
| 916 | Lilliefors Test Statistic                                                        | 0.0902 |   |   |   |   | <b>Lilliefors Lognormal GOF Test</b>                            |       |   |   |   |
| 917 | 5% Lilliefors Critical Value                                                     | 0.15   |   |   |   |   | Data appear Lognormal at 5% Significance Level                  |       |   |   |   |
| 918 | <b>Data appear Lognormal at 5% Significance Level</b>                            |        |   |   |   |   |                                                                 |       |   |   |   |
| 919 |                                                                                  |        |   |   |   |   |                                                                 |       |   |   |   |
| 920 | <b>Lognormal Statistics</b>                                                      |        |   |   |   |   |                                                                 |       |   |   |   |
| 921 | Minimum of Logged Data                                                           | 1.16   |   |   |   |   | Mean of logged Data                                             | 2.86  |   |   |   |
| 922 | Maximum of Logged Data                                                           | 4.663  |   |   |   |   | SD of logged Data                                               | 0.905 |   |   |   |
| 923 |                                                                                  |        |   |   |   |   |                                                                 |       |   |   |   |
| 924 | <b>Assuming Lognormal Distribution</b>                                           |        |   |   |   |   |                                                                 |       |   |   |   |
| 925 | 95% H-UCL                                                                        | 38.02  |   |   |   |   | 90% Chebyshev (MVUE) UCL                                        | 39.52 |   |   |   |
| 926 | 95% Chebyshev (MVUE) UCL                                                         | 45.71  |   |   |   |   | 97.5% Chebyshev (MVUE) UCL                                      | 54.29 |   |   |   |
| 927 | 99% Chebyshev (MVUE) UCL                                                         | 71.15  |   |   |   |   |                                                                 |       |   |   |   |
| 928 |                                                                                  |        |   |   |   |   |                                                                 |       |   |   |   |
| 929 | <b>Nonparametric Distribution Free UCL Statistics</b>                            |        |   |   |   |   |                                                                 |       |   |   |   |
| 930 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b> |        |   |   |   |   |                                                                 |       |   |   |   |
| 931 |                                                                                  |        |   |   |   |   |                                                                 |       |   |   |   |
| 932 | <b>Nonparametric Distribution Free UCLs</b>                                      |        |   |   |   |   |                                                                 |       |   |   |   |
| 933 | 95% CLT UCL                                                                      | 33.16  |   |   |   |   | 95% Jackknife UCL                                               | 33.37 |   |   |   |
| 934 | 95% Standard Bootstrap UCL                                                       | 33.08  |   |   |   |   | 95% Bootstrap-t UCL                                             | 35.83 |   |   |   |
| 935 | 95% Hall's Bootstrap UCL                                                         | 35.02  |   |   |   |   | 95% Percentile Bootstrap UCL                                    | 33.41 |   |   |   |
| 936 | 95% BCA Bootstrap UCL                                                            | 34.6   |   |   |   |   |                                                                 |       |   |   |   |
| 937 | 90% Chebyshev(Mean, Sd) UCL                                                      | 39.12  |   |   |   |   | 95% Chebyshev(Mean, Sd) UCL                                     | 45.09 |   |   |   |
| 938 | 97.5% Chebyshev(Mean, Sd) UCL                                                    | 53.39  |   |   |   |   | 99% Chebyshev(Mean, Sd) UCL                                     | 69.68 |   |   |   |

| A    | B                                                                                                                                        | C | D      | E | F                                                   | G | H     | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|---|-----------------------------------------------------|---|-------|---|---|---|---|
| 939  |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 940  | <b>Suggested UCL to Use</b>                                                                                                              |   |        |   |                                                     |   |       |   |   |   |   |
| 941  | 95% Adjusted Gamma UCL                                                                                                                   |   | 34.28  |   |                                                     |   |       |   |   |   |   |
| 942  |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 943  | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |   |                                                     |   |       |   |   |   |   |
| 944  | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |   |                                                     |   |       |   |   |   |   |
| 945  | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |   |                                                     |   |       |   |   |   |   |
| 946  | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |   |                                                     |   |       |   |   |   |   |
| 947  |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 948  |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 949  | <b>Result (eu2_cadmium_roadway)</b>                                                                                                      |   |        |   |                                                     |   |       |   |   |   |   |
| 950  |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 951  | <b>General Statistics</b>                                                                                                                |   |        |   |                                                     |   |       |   |   |   |   |
| 952  | Total Number of Observations                                                                                                             |   | 34     |   | Number of Distinct Observations                     |   | 33    |   |   |   |   |
| 953  |                                                                                                                                          |   |        |   | Number of Missing Observations                      |   | 0     |   |   |   |   |
| 954  | Minimum                                                                                                                                  |   | 0.291  |   | Mean                                                |   | 3.685 |   |   |   |   |
| 955  | Maximum                                                                                                                                  |   | 24.9   |   | Median                                              |   | 1.3   |   |   |   |   |
| 956  | SD                                                                                                                                       |   | 5.615  |   | Std. Error of Mean                                  |   | 0.963 |   |   |   |   |
| 957  | Coefficient of Variation                                                                                                                 |   | 1.524  |   | Skewness                                            |   | 2.518 |   |   |   |   |
| 958  |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 959  | <b>Normal GOF Test</b>                                                                                                                   |   |        |   |                                                     |   |       |   |   |   |   |
| 960  | Shapiro Wilk Test Statistic                                                                                                              |   | 0.618  |   | <b>Shapiro Wilk GOF Test</b>                        |   |       |   |   |   |   |
| 961  | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.933  |   | Data Not Normal at 5% Significance Level            |   |       |   |   |   |   |
| 962  | Lilliefors Test Statistic                                                                                                                |   | 0.32   |   | <b>Lilliefors GOF Test</b>                          |   |       |   |   |   |   |
| 963  | 5% Lilliefors Critical Value                                                                                                             |   | 0.15   |   | Data Not Normal at 5% Significance Level            |   |       |   |   |   |   |
| 964  | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 965  |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 966  | <b>Assuming Normal Distribution</b>                                                                                                      |   |        |   |                                                     |   |       |   |   |   |   |
| 967  | <b>95% Normal UCL</b>                                                                                                                    |   |        |   | <b>95% UCLs (Adjusted for Skewness)</b>             |   |       |   |   |   |   |
| 968  | 95% Student's-t UCL                                                                                                                      |   | 5.315  |   | 95% Adjusted-CLT UCL (Chen-1995)                    |   | 5.713 |   |   |   |   |
| 969  |                                                                                                                                          |   |        |   | 95% Modified-t UCL (Johnson-1978)                   |   | 5.384 |   |   |   |   |
| 970  |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 971  | <b>Gamma GOF Test</b>                                                                                                                    |   |        |   |                                                     |   |       |   |   |   |   |
| 972  | A-D Test Statistic                                                                                                                       |   | 2.123  |   | <b>Anderson-Darling Gamma GOF Test</b>              |   |       |   |   |   |   |
| 973  | 5% A-D Critical Value                                                                                                                    |   | 0.786  |   | Data Not Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |
| 974  | K-S Test Statistic                                                                                                                       |   | 0.206  |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |       |   |   |   |   |
| 975  | 5% K-S Critical Value                                                                                                                    |   | 0.157  |   | Data Not Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |
| 976  | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |        |   |                                                     |   |       |   |   |   |   |
| 977  |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 978  | <b>Gamma Statistics</b>                                                                                                                  |   |        |   |                                                     |   |       |   |   |   |   |
| 979  | k hat (MLE)                                                                                                                              |   | 0.794  |   | k star (bias corrected MLE)                         |   | 0.744 |   |   |   |   |
| 980  | Theta hat (MLE)                                                                                                                          |   | 4.641  |   | Theta star (bias corrected MLE)                     |   | 4.956 |   |   |   |   |
| 981  | nu hat (MLE)                                                                                                                             |   | 53.99  |   | nu star (bias corrected)                            |   | 50.56 |   |   |   |   |
| 982  | MLE Mean (bias corrected)                                                                                                                |   | 3.685  |   | MLE Sd (bias corrected)                             |   | 4.274 |   |   |   |   |
| 983  |                                                                                                                                          |   |        |   | Approximate Chi Square Value (0.05)                 |   | 35.23 |   |   |   |   |
| 984  | Adjusted Level of Significance                                                                                                           |   | 0.0422 |   | Adjusted Chi Square Value                           |   | 34.6  |   |   |   |   |
| 985  |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 986  | <b>Assuming Gamma Distribution</b>                                                                                                       |   |        |   |                                                     |   |       |   |   |   |   |
| 987  | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   | 5.288  |   | 95% Adjusted Gamma UCL (use when n<50)              |   | 5.385 |   |   |   |   |
| 988  |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 989  | <b>Lognormal GOF Test</b>                                                                                                                |   |        |   |                                                     |   |       |   |   |   |   |
| 990  | Shapiro Wilk Test Statistic                                                                                                              |   | 0.931  |   | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |       |   |   |   |   |
| 991  | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.933  |   | Data Not Lognormal at 5% Significance Level         |   |       |   |   |   |   |
| 992  | Lilliefors Test Statistic                                                                                                                |   | 0.152  |   | <b>Lilliefors Lognormal GOF Test</b>                |   |       |   |   |   |   |
| 993  | 5% Lilliefors Critical Value                                                                                                             |   | 0.15   |   | Data Not Lognormal at 5% Significance Level         |   |       |   |   |   |   |
| 994  | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |   |        |   |                                                     |   |       |   |   |   |   |
| 995  |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 996  | <b>Lognormal Statistics</b>                                                                                                              |   |        |   |                                                     |   |       |   |   |   |   |
| 997  | Minimum of Logged Data                                                                                                                   |   | -1.234 |   | Mean of logged Data                                 |   | 0.556 |   |   |   |   |
| 998  | Maximum of Logged Data                                                                                                                   |   | 3.215  |   | SD of logged Data                                   |   | 1.152 |   |   |   |   |
| 999  |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 1000 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |        |   |                                                     |   |       |   |   |   |   |
| 1001 | 95% H-UCL                                                                                                                                |   | 5.75   |   | 90% Chebyshev (MVUE) UCL                            |   | 5.612 |   |   |   |   |
| 1002 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 6.666  |   | 97.5% Chebyshev (MVUE) UCL                          |   | 8.13  |   |   |   |   |
| 1003 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 11     |   |                                                     |   |       |   |   |   |   |
| 1004 |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 1005 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |        |   |                                                     |   |       |   |   |   |   |

| A    | B                                                                                                                                        | C | D      | E | F                                                               | G | H     | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|---|-----------------------------------------------------------------|---|-------|---|---|---|---|
| 1006 | Data do not follow a Discernible Distribution (0.05)                                                                                     |   |        |   |                                                                 |   |       |   |   |   |   |
| 1007 |                                                                                                                                          |   |        |   |                                                                 |   |       |   |   |   |   |
| 1008 | Nonparametric Distribution Free UCLs                                                                                                     |   |        |   |                                                                 |   |       |   |   |   |   |
| 1009 | 95% CLT UCL                                                                                                                              |   | 5.269  |   | 95% Jackknife UCL                                               |   | 5.315 |   |   |   |   |
| 1010 | 95% Standard Bootstrap UCL                                                                                                               |   | 5.191  |   | 95% Bootstrap-t UCL                                             |   | 6.334 |   |   |   |   |
| 1011 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 5.806  |   | 95% Percentile Bootstrap UCL                                    |   | 5.475 |   |   |   |   |
| 1012 | 95% BCA Bootstrap UCL                                                                                                                    |   | 5.785  |   |                                                                 |   |       |   |   |   |   |
| 1013 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 6.574  |   | 95% Chebyshev(Mean, Sd) UCL                                     |   | 7.882 |   |   |   |   |
| 1014 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 9.699  |   | 99% Chebyshev(Mean, Sd) UCL                                     |   | 13.27 |   |   |   |   |
| 1015 |                                                                                                                                          |   |        |   |                                                                 |   |       |   |   |   |   |
| 1016 | Suggested UCL to Use                                                                                                                     |   |        |   |                                                                 |   |       |   |   |   |   |
| 1017 | 95% Chebyshev (Mean, Sd) UCL                                                                                                             |   | 7.882  |   |                                                                 |   |       |   |   |   |   |
| 1018 |                                                                                                                                          |   |        |   |                                                                 |   |       |   |   |   |   |
| 1019 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |   |                                                                 |   |       |   |   |   |   |
| 1020 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |   |                                                                 |   |       |   |   |   |   |
| 1021 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |   |                                                                 |   |       |   |   |   |   |
| 1022 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |   |                                                                 |   |       |   |   |   |   |
| 1023 |                                                                                                                                          |   |        |   |                                                                 |   |       |   |   |   |   |
| 1024 |                                                                                                                                          |   |        |   |                                                                 |   |       |   |   |   |   |
| 1025 | Result (eu2_chromium_roadway)                                                                                                            |   |        |   |                                                                 |   |       |   |   |   |   |
| 1026 |                                                                                                                                          |   |        |   |                                                                 |   |       |   |   |   |   |
| 1027 | General Statistics                                                                                                                       |   |        |   |                                                                 |   |       |   |   |   |   |
| 1028 | Total Number of Observations                                                                                                             |   | 34     |   | Number of Distinct Observations                                 |   | 27    |   |   |   |   |
| 1029 |                                                                                                                                          |   |        |   | Number of Missing Observations                                  |   | 0     |   |   |   |   |
| 1030 | Minimum                                                                                                                                  |   | 2.27   |   | Mean                                                            |   | 4.271 |   |   |   |   |
| 1031 | Maximum                                                                                                                                  |   | 7.3    |   | Median                                                          |   | 3.89  |   |   |   |   |
| 1032 | SD                                                                                                                                       |   | 1.305  |   | Std. Error of Mean                                              |   | 0.224 |   |   |   |   |
| 1033 | Coefficient of Variation                                                                                                                 |   | 0.306  |   | Skewness                                                        |   | 0.524 |   |   |   |   |
| 1034 |                                                                                                                                          |   |        |   |                                                                 |   |       |   |   |   |   |
| 1035 | Normal GOF Test                                                                                                                          |   |        |   |                                                                 |   |       |   |   |   |   |
| 1036 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.938  |   | Shapiro Wilk GOF Test                                           |   |       |   |   |   |   |
| 1037 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.933  |   | Data appear Normal at 5% Significance Level                     |   |       |   |   |   |   |
| 1038 | Lilliefors Test Statistic                                                                                                                |   | 0.171  |   | Lilliefors GOF Test                                             |   |       |   |   |   |   |
| 1039 | 5% Lilliefors Critical Value                                                                                                             |   | 0.15   |   | Data Not Normal at 5% Significance Level                        |   |       |   |   |   |   |
| 1040 | Data appear Approximate Normal at 5% Significance Level                                                                                  |   |        |   |                                                                 |   |       |   |   |   |   |
| 1041 |                                                                                                                                          |   |        |   |                                                                 |   |       |   |   |   |   |
| 1042 | Assuming Normal Distribution                                                                                                             |   |        |   |                                                                 |   |       |   |   |   |   |
| 1043 | 95% Normal UCL                                                                                                                           |   |        |   | 95% UCLs (Adjusted for Skewness)                                |   |       |   |   |   |   |
| 1044 | 95% Student's-t UCL                                                                                                                      |   | 4.65   |   | 95% Adjusted-CLT UCL (Chen-1995)                                |   | 4.661 |   |   |   |   |
| 1045 |                                                                                                                                          |   |        |   | 95% Modified-t UCL (Johnson-1978)                               |   | 4.653 |   |   |   |   |
| 1046 |                                                                                                                                          |   |        |   |                                                                 |   |       |   |   |   |   |
| 1047 | Gamma GOF Test                                                                                                                           |   |        |   |                                                                 |   |       |   |   |   |   |
| 1048 | A-D Test Statistic                                                                                                                       |   | 0.551  |   | Anderson-Darling Gamma GOF Test                                 |   |       |   |   |   |   |
| 1049 | 5% A-D Critical Value                                                                                                                    |   | 0.748  |   | Detected data appear Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |
| 1050 | K-S Test Statistic                                                                                                                       |   | 0.138  |   | Kolmogorov-Smirnov Gamma GOF Test                               |   |       |   |   |   |   |
| 1051 | 5% K-S Critical Value                                                                                                                    |   | 0.151  |   | Detected data appear Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |
| 1052 | Detected data appear Gamma Distributed at 5% Significance Level                                                                          |   |        |   |                                                                 |   |       |   |   |   |   |
| 1053 |                                                                                                                                          |   |        |   |                                                                 |   |       |   |   |   |   |
| 1054 | Gamma Statistics                                                                                                                         |   |        |   |                                                                 |   |       |   |   |   |   |
| 1055 | k hat (MLE)                                                                                                                              |   | 11.31  |   | k star (bias corrected MLE)                                     |   | 10.33 |   |   |   |   |
| 1056 | Theta hat (MLE)                                                                                                                          |   | 0.378  |   | Theta star (bias corrected MLE)                                 |   | 0.413 |   |   |   |   |
| 1057 | nu hat (MLE)                                                                                                                             |   | 768.9  |   | nu star (bias corrected)                                        |   | 702.4 |   |   |   |   |
| 1058 | MLE Mean (bias corrected)                                                                                                                |   | 4.271  |   | MLE Sd (bias corrected)                                         |   | 1.329 |   |   |   |   |
| 1059 |                                                                                                                                          |   |        |   | Approximate Chi Square Value (0.05)                             |   | 641.9 |   |   |   |   |
| 1060 | Adjusted Level of Significance                                                                                                           |   | 0.0422 |   | Adjusted Chi Square Value                                       |   | 639.1 |   |   |   |   |
| 1061 |                                                                                                                                          |   |        |   |                                                                 |   |       |   |   |   |   |
| 1062 | Assuming Gamma Distribution                                                                                                              |   |        |   |                                                                 |   |       |   |   |   |   |
| 1063 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   | 4.673  |   | 95% Adjusted Gamma UCL (use when n<50)                          |   | 4.694 |   |   |   |   |
| 1064 |                                                                                                                                          |   |        |   |                                                                 |   |       |   |   |   |   |
| 1065 | Lognormal GOF Test                                                                                                                       |   |        |   |                                                                 |   |       |   |   |   |   |
| 1066 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.962  |   | Shapiro Wilk Lognormal GOF Test                                 |   |       |   |   |   |   |
| 1067 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.933  |   | Data appear Lognormal at 5% Significance Level                  |   |       |   |   |   |   |
| 1068 | Lilliefors Test Statistic                                                                                                                |   | 0.119  |   | Lilliefors Lognormal GOF Test                                   |   |       |   |   |   |   |
| 1069 | 5% Lilliefors Critical Value                                                                                                             |   | 0.15   |   | Data appear Lognormal at 5% Significance Level                  |   |       |   |   |   |   |
| 1070 | Data appear Lognormal at 5% Significance Level                                                                                           |   |        |   |                                                                 |   |       |   |   |   |   |
| 1071 |                                                                                                                                          |   |        |   |                                                                 |   |       |   |   |   |   |
| 1072 | Lognormal Statistics                                                                                                                     |   |        |   |                                                                 |   |       |   |   |   |   |

| A    | B                                                                                                                                        | C                              | D | E      | F                                                               | G                                       | H | I     | J     | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|---|--------|-----------------------------------------------------------------|-----------------------------------------|---|-------|-------|---|---|
| 1073 |                                                                                                                                          | Minimum of Logged Data         |   |        | 0.82                                                            | Mean of logged Data                     |   |       | 1.407 |   |   |
| 1074 |                                                                                                                                          | Maximum of Logged Data         |   |        | 1.988                                                           | SD of logged Data                       |   |       | 0.304 |   |   |
| 1075 |                                                                                                                                          |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1076 | <b>Assuming Lognormal Distribution</b>                                                                                                   |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1077 |                                                                                                                                          | 95% H-UCL                      |   | 4.706  | 90% Chebyshev (MVUE) UCL                                        |                                         |   | 4.952 |       |   |   |
| 1078 |                                                                                                                                          | 95% Chebyshev (MVUE) UCL       |   |        | 5.26                                                            | 97.5% Chebyshev (MVUE) UCL              |   |       | 5.688 |   |   |
| 1079 |                                                                                                                                          | 99% Chebyshev (MVUE) UCL       |   |        | 6.529                                                           |                                         |   |       |       |   |   |
| 1080 |                                                                                                                                          |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1081 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1082 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1083 |                                                                                                                                          |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1084 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1085 |                                                                                                                                          | 95% CLT UCL                    |   | 4.639  | 95% Jackknife UCL                                               |                                         |   | 4.65  |       |   |   |
| 1086 |                                                                                                                                          | 95% Standard Bootstrap UCL     |   |        | 4.641                                                           | 95% Bootstrap-t UCL                     |   |       | 4.678 |   |   |
| 1087 |                                                                                                                                          | 95% Hall's Bootstrap UCL       |   |        | 4.655                                                           | 95% Percentile Bootstrap UCL            |   |       | 4.635 |   |   |
| 1088 |                                                                                                                                          | 95% BCA Bootstrap UCL          |   |        | 4.653                                                           |                                         |   |       |       |   |   |
| 1089 |                                                                                                                                          | 90% Chebyshev(Mean, Sd) UCL    |   |        | 4.942                                                           | 95% Chebyshev(Mean, Sd) UCL             |   |       | 5.247 |   |   |
| 1090 |                                                                                                                                          | 97.5% Chebyshev(Mean, Sd) UCL  |   |        | 5.669                                                           | 99% Chebyshev(Mean, Sd) UCL             |   |       | 6.498 |   |   |
| 1091 |                                                                                                                                          |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1092 | <b>Suggested UCL to Use</b>                                                                                                              |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1093 |                                                                                                                                          | 95% Student's-t UCL            |   | 4.65   |                                                                 |                                         |   |       |       |   |   |
| 1094 |                                                                                                                                          |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1095 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                           |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1096 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                   |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1097 |                                                                                                                                          |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1098 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1099 | Recommendations are based upon data size, data distribution, and skewness.                                                               |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1100 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1101 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1102 |                                                                                                                                          |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1103 |                                                                                                                                          |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1104 | <b>Result (eu2_cobalt_roadway)</b>                                                                                                       |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1105 |                                                                                                                                          |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1106 | <b>General Statistics</b>                                                                                                                |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1107 |                                                                                                                                          | Total Number of Observations   |   | 34     | Number of Distinct Observations                                 |                                         |   | 29    |       |   |   |
| 1108 |                                                                                                                                          |                                |   |        |                                                                 | Number of Missing Observations          |   |       | 0     |   |   |
| 1109 |                                                                                                                                          | Minimum                        |   | 2.98   | Mean                                                            |                                         |   | 6.214 |       |   |   |
| 1110 |                                                                                                                                          | Maximum                        |   | 11.1   | Median                                                          |                                         |   | 6.05  |       |   |   |
| 1111 |                                                                                                                                          | SD                             |   | 2.022  | Std. Error of Mean                                              |                                         |   | 0.347 |       |   |   |
| 1112 |                                                                                                                                          | Coefficient of Variation       |   | 0.325  | Skewness                                                        |                                         |   | 0.628 |       |   |   |
| 1113 |                                                                                                                                          |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1114 | <b>Normal GOF Test</b>                                                                                                                   |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1115 |                                                                                                                                          | Shapiro Wilk Test Statistic    |   | 0.957  | <b>Shapiro Wilk GOF Test</b>                                    |                                         |   |       |       |   |   |
| 1116 |                                                                                                                                          | 5% Shapiro Wilk Critical Value |   | 0.933  | Data appear Normal at 5% Significance Level                     |                                         |   |       |       |   |   |
| 1117 |                                                                                                                                          | Lilliefors Test Statistic      |   | 0.116  | <b>Lilliefors GOF Test</b>                                      |                                         |   |       |       |   |   |
| 1118 |                                                                                                                                          | 5% Lilliefors Critical Value   |   | 0.15   | Data appear Normal at 5% Significance Level                     |                                         |   |       |       |   |   |
| 1119 | <b>Data appear Normal at 5% Significance Level</b>                                                                                       |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1120 |                                                                                                                                          |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1121 | <b>Assuming Normal Distribution</b>                                                                                                      |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1122 |                                                                                                                                          | <b>95% Normal UCL</b>          |   |        |                                                                 | <b>95% UCLs (Adjusted for Skewness)</b> |   |       |       |   |   |
| 1123 |                                                                                                                                          | 95% Student's-t UCL            |   | 6.801  | 95% Adjusted-CLT UCL (Chen-1995)                                |                                         |   | 6.824 |       |   |   |
| 1124 |                                                                                                                                          |                                |   |        |                                                                 | 95% Modified-t UCL (Johnson-1978)       |   |       | 6.807 |   |   |
| 1125 |                                                                                                                                          |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1126 | <b>Gamma GOF Test</b>                                                                                                                    |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1127 |                                                                                                                                          | A-D Test Statistic             |   | 0.178  | <b>Anderson-Darling Gamma GOF Test</b>                          |                                         |   |       |       |   |   |
| 1128 |                                                                                                                                          | 5% A-D Critical Value          |   | 0.748  | Detected data appear Gamma Distributed at 5% Significance Level |                                         |   |       |       |   |   |
| 1129 |                                                                                                                                          | K-S Test Statistic             |   | 0.09   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |                                         |   |       |       |   |   |
| 1130 |                                                                                                                                          | 5% K-S Critical Value          |   | 0.151  | Detected data appear Gamma Distributed at 5% Significance Level |                                         |   |       |       |   |   |
| 1131 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1132 |                                                                                                                                          |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1133 | <b>Gamma Statistics</b>                                                                                                                  |                                |   |        |                                                                 |                                         |   |       |       |   |   |
| 1134 |                                                                                                                                          | k hat (MLE)                    |   | 9.966  | k star (bias corrected MLE)                                     |                                         |   | 9.107 |       |   |   |
| 1135 |                                                                                                                                          | Theta hat (MLE)                |   | 0.624  | Theta star (bias corrected MLE)                                 |                                         |   | 0.682 |       |   |   |
| 1136 |                                                                                                                                          | nu hat (MLE)                   |   | 677.7  | nu star (bias corrected)                                        |                                         |   | 619.3 |       |   |   |
| 1137 |                                                                                                                                          | MLE Mean (bias corrected)      |   | 6.214  | MLE Sd (bias corrected)                                         |                                         |   | 2.059 |       |   |   |
| 1138 |                                                                                                                                          |                                |   |        |                                                                 | Approximate Chi Square Value (0.05)     |   |       | 562.5 |   |   |
| 1139 |                                                                                                                                          | Adjusted Level of Significance |   | 0.0422 | Adjusted Chi Square Value                                       |                                         |   | 559.9 |       |   |   |

|      | A                                                                                                                                        | B | C | D | E      | F                                                               | G                                      | H | I | J     | K | L     |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|--------|-----------------------------------------------------------------|----------------------------------------|---|---|-------|---|-------|
| 1140 |                                                                                                                                          |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1141 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1142 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |   |   |        | 6.841                                                           | 95% Adjusted Gamma UCL (use when n<50) |   |   |       |   | 6.873 |
| 1143 |                                                                                                                                          |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1144 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1145 | Shapiro Wilk Test Statistic                                                                                                              |   |   |   | 0.983  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |                                        |   |   |       |   |       |
| 1146 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   |   | 0.933  | Data appear Lognormal at 5% Significance Level                  |                                        |   |   |       |   |       |
| 1147 | Lilliefors Test Statistic                                                                                                                |   |   |   | 0.0711 | <b>Lilliefors Lognormal GOF Test</b>                            |                                        |   |   |       |   |       |
| 1148 | 5% Lilliefors Critical Value                                                                                                             |   |   |   | 0.15   | Data appear Lognormal at 5% Significance Level                  |                                        |   |   |       |   |       |
| 1149 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1150 |                                                                                                                                          |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1151 | <b>Lognormal Statistics</b>                                                                                                              |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1152 | Minimum of Logged Data                                                                                                                   |   |   |   | 1.092  | Mean of logged Data                                             |                                        |   |   | 1.776 |   |       |
| 1153 | Maximum of Logged Data                                                                                                                   |   |   |   | 2.407  | SD of logged Data                                               |                                        |   |   | 0.326 |   |       |
| 1154 |                                                                                                                                          |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1155 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1156 | 95% H-UCL                                                                                                                                |   |   |   | 6.903  | 90% Chebyshev (MVUE) UCL                                        |                                        |   |   | 7.281 |   |       |
| 1157 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   |   | 7.763  | 97.5% Chebyshev (MVUE) UCL                                      |                                        |   |   | 8.432 |   |       |
| 1158 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   |   | 9.746  |                                                                 |                                        |   |   |       |   |       |
| 1159 |                                                                                                                                          |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1160 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1161 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1162 |                                                                                                                                          |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1163 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1164 | 95% CLT UCL                                                                                                                              |   |   |   | 6.784  | 95% Jackknife UCL                                               |                                        |   |   | 6.801 |   |       |
| 1165 | 95% Standard Bootstrap UCL                                                                                                               |   |   |   | 6.776  | 95% Bootstrap-t UCL                                             |                                        |   |   | 6.869 |   |       |
| 1166 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   |   | 6.864  | 95% Percentile Bootstrap UCL                                    |                                        |   |   | 6.769 |   |       |
| 1167 | 95% BCA Bootstrap UCL                                                                                                                    |   |   |   | 6.831  |                                                                 |                                        |   |   |       |   |       |
| 1168 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   |   | 7.254  | 95% Chebyshev(Mean, Sd) UCL                                     |                                        |   |   | 7.725 |   |       |
| 1169 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   |   | 8.379  | 99% Chebyshev(Mean, Sd) UCL                                     |                                        |   |   | 9.664 |   |       |
| 1170 |                                                                                                                                          |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1171 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1172 | 95% Student's-t UCL                                                                                                                      |   |   |   | 6.801  |                                                                 |                                        |   |   |       |   |       |
| 1173 |                                                                                                                                          |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1174 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1175 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1176 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1177 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1178 |                                                                                                                                          |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1179 |                                                                                                                                          |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1180 | <b>Result (eu2_iron_roadway)</b>                                                                                                         |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1181 |                                                                                                                                          |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1182 | <b>General Statistics</b>                                                                                                                |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1183 | Total Number of Observations                                                                                                             |   |   |   | 34     | Number of Distinct Observations                                 |                                        |   |   | 33    |   |       |
| 1184 |                                                                                                                                          |   |   |   |        | Number of Missing Observations                                  |                                        |   |   | 0     |   |       |
| 1185 | Minimum                                                                                                                                  |   |   |   | 10400  | Mean                                                            |                                        |   |   | 22862 |   |       |
| 1186 | Maximum                                                                                                                                  |   |   |   | 49800  | Median                                                          |                                        |   |   | 22600 |   |       |
| 1187 | SD                                                                                                                                       |   |   |   | 7607   | Std. Error of Mean                                              |                                        |   |   | 1305  |   |       |
| 1188 | Coefficient of Variation                                                                                                                 |   |   |   | 0.333  | Skewness                                                        |                                        |   |   | 1.158 |   |       |
| 1189 |                                                                                                                                          |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1190 | <b>Normal GOF Test</b>                                                                                                                   |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1191 | Shapiro Wilk Test Statistic                                                                                                              |   |   |   | 0.928  | <b>Shapiro Wilk GOF Test</b>                                    |                                        |   |   |       |   |       |
| 1192 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   |   | 0.933  | Data Not Normal at 5% Significance Level                        |                                        |   |   |       |   |       |
| 1193 | Lilliefors Test Statistic                                                                                                                |   |   |   | 0.0902 | <b>Lilliefors GOF Test</b>                                      |                                        |   |   |       |   |       |
| 1194 | 5% Lilliefors Critical Value                                                                                                             |   |   |   | 0.15   | Data appear Normal at 5% Significance Level                     |                                        |   |   |       |   |       |
| 1195 | <b>Data appear Approximate Normal at 5% Significance Level</b>                                                                           |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1196 |                                                                                                                                          |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1197 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1198 | <b>95% Normal UCL</b>                                                                                                                    |   |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>                         |                                        |   |   |       |   |       |
| 1199 | 95% Student's-t UCL                                                                                                                      |   |   |   | 25070  | 95% Adjusted-CLT UCL (Chen-1995)                                |                                        |   |   | 25284 |   |       |
| 1200 |                                                                                                                                          |   |   |   |        | 95% Modified-t UCL (Johnson-1978)                               |                                        |   |   | 25113 |   |       |
| 1201 |                                                                                                                                          |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1202 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |   |        |                                                                 |                                        |   |   |       |   |       |
| 1203 | A-D Test Statistic                                                                                                                       |   |   |   | 0.328  | <b>Anderson-Darling Gamma GOF Test</b>                          |                                        |   |   |       |   |       |
| 1204 | 5% A-D Critical Value                                                                                                                    |   |   |   | 0.748  | Detected data appear Gamma Distributed at 5% Significance Level |                                        |   |   |       |   |       |
| 1205 | K-S Test Statistic                                                                                                                       |   |   |   | 0.083  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |                                        |   |   |       |   |       |
| 1206 | 5% K-S Critical Value                                                                                                                    |   |   |   | 0.151  | Detected data appear Gamma Distributed at 5% Significance Level |                                        |   |   |       |   |       |

| A    | B                                                                                                                                        | C      | D                                              | E     | F | G | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------|------------------------------------------------|-------|---|---|---|---|---|---|---|
| 1207 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |        |                                                |       |   |   |   |   |   |   |   |
| 1208 |                                                                                                                                          |        |                                                |       |   |   |   |   |   |   |   |
| 1209 | <b>Gamma Statistics</b>                                                                                                                  |        |                                                |       |   |   |   |   |   |   |   |
| 1210 | k hat (MLE)                                                                                                                              | 9.779  | k star (bias corrected MLE)                    | 8.935 |   |   |   |   |   |   |   |
| 1211 | Theta hat (MLE)                                                                                                                          | 2338   | Theta star (bias corrected MLE)                | 2559  |   |   |   |   |   |   |   |
| 1212 | nu hat (MLE)                                                                                                                             | 665    | nu star (bias corrected)                       | 607.6 |   |   |   |   |   |   |   |
| 1213 | MLE Mean (bias corrected)                                                                                                                | 22862  | MLE Sd (bias corrected)                        | 7648  |   |   |   |   |   |   |   |
| 1214 |                                                                                                                                          |        | Approximate Chi Square Value (0.05)            | 551.4 |   |   |   |   |   |   |   |
| 1215 | Adjusted Level of Significance                                                                                                           | 0.0422 | Adjusted Chi Square Value                      | 548.8 |   |   |   |   |   |   |   |
| 1216 |                                                                                                                                          |        |                                                |       |   |   |   |   |   |   |   |
| 1217 | <b>Assuming Gamma Distribution</b>                                                                                                       |        |                                                |       |   |   |   |   |   |   |   |
| 1218 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | 25191  | 95% Adjusted Gamma UCL (use when n<50)         | 25312 |   |   |   |   |   |   |   |
| 1219 |                                                                                                                                          |        |                                                |       |   |   |   |   |   |   |   |
| 1220 | <b>Lognormal GOF Test</b>                                                                                                                |        |                                                |       |   |   |   |   |   |   |   |
| 1221 | Shapiro Wilk Test Statistic                                                                                                              | 0.971  | <b>Shapiro Wilk Lognormal GOF Test</b>         |       |   |   |   |   |   |   |   |
| 1222 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.933  | Data appear Lognormal at 5% Significance Level |       |   |   |   |   |   |   |   |
| 1223 | Lilliefors Test Statistic                                                                                                                | 0.102  | <b>Lilliefors Lognormal GOF Test</b>           |       |   |   |   |   |   |   |   |
| 1224 | 5% Lilliefors Critical Value                                                                                                             | 0.15   | Data appear Lognormal at 5% Significance Level |       |   |   |   |   |   |   |   |
| 1225 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |        |                                                |       |   |   |   |   |   |   |   |
| 1226 |                                                                                                                                          |        |                                                |       |   |   |   |   |   |   |   |
| 1227 | <b>Lognormal Statistics</b>                                                                                                              |        |                                                |       |   |   |   |   |   |   |   |
| 1228 | Minimum of Logged Data                                                                                                                   | 9.25   | Mean of logged Data                            | 9.985 |   |   |   |   |   |   |   |
| 1229 | Maximum of Logged Data                                                                                                                   | 10.82  | SD of logged Data                              | 0.331 |   |   |   |   |   |   |   |
| 1230 |                                                                                                                                          |        |                                                |       |   |   |   |   |   |   |   |
| 1231 | <b>Assuming Lognormal Distribution</b>                                                                                                   |        |                                                |       |   |   |   |   |   |   |   |
| 1232 | 95% H-UCL                                                                                                                                | 25449  | 90% Chebyshev (MVUE) UCL                       | 26855 |   |   |   |   |   |   |   |
| 1233 | 95% Chebyshev (MVUE) UCL                                                                                                                 | 28654  | 97.5% Chebyshev (MVUE) UCL                     | 31151 |   |   |   |   |   |   |   |
| 1234 | 99% Chebyshev (MVUE) UCL                                                                                                                 | 36056  |                                                |       |   |   |   |   |   |   |   |
| 1235 |                                                                                                                                          |        |                                                |       |   |   |   |   |   |   |   |
| 1236 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |                                                |       |   |   |   |   |   |   |   |
| 1237 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |        |                                                |       |   |   |   |   |   |   |   |
| 1238 |                                                                                                                                          |        |                                                |       |   |   |   |   |   |   |   |
| 1239 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |        |                                                |       |   |   |   |   |   |   |   |
| 1240 | 95% CLT UCL                                                                                                                              | 25008  | 95% Jackknife UCL                              | 25070 |   |   |   |   |   |   |   |
| 1241 | 95% Standard Bootstrap UCL                                                                                                               | 24966  | 95% Bootstrap-t UCL                            | 25393 |   |   |   |   |   |   |   |
| 1242 | 95% Hall's Bootstrap UCL                                                                                                                 | 25723  | 95% Percentile Bootstrap UCL                   | 25124 |   |   |   |   |   |   |   |
| 1243 | 95% BCA Bootstrap UCL                                                                                                                    | 25282  |                                                |       |   |   |   |   |   |   |   |
| 1244 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              | 26775  | 95% Chebyshev(Mean, Sd) UCL                    | 28548 |   |   |   |   |   |   |   |
| 1245 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            | 31009  | 99% Chebyshev(Mean, Sd) UCL                    | 35842 |   |   |   |   |   |   |   |
| 1246 |                                                                                                                                          |        |                                                |       |   |   |   |   |   |   |   |
| 1247 | <b>Suggested UCL to Use</b>                                                                                                              |        |                                                |       |   |   |   |   |   |   |   |
| 1248 | 95% Student's-t UCL                                                                                                                      | 25070  |                                                |       |   |   |   |   |   |   |   |
| 1249 |                                                                                                                                          |        |                                                |       |   |   |   |   |   |   |   |
| 1250 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                           |        |                                                |       |   |   |   |   |   |   |   |
| 1251 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                   |        |                                                |       |   |   |   |   |   |   |   |
| 1252 |                                                                                                                                          |        |                                                |       |   |   |   |   |   |   |   |
| 1253 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |                                                |       |   |   |   |   |   |   |   |
| 1254 | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |                                                |       |   |   |   |   |   |   |   |
| 1255 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |                                                |       |   |   |   |   |   |   |   |
| 1256 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |                                                |       |   |   |   |   |   |   |   |
| 1257 |                                                                                                                                          |        |                                                |       |   |   |   |   |   |   |   |
| 1258 |                                                                                                                                          |        |                                                |       |   |   |   |   |   |   |   |
| 1259 | <b>Result (eu2_lead_roadway)</b>                                                                                                         |        |                                                |       |   |   |   |   |   |   |   |
| 1260 |                                                                                                                                          |        |                                                |       |   |   |   |   |   |   |   |
| 1261 | <b>General Statistics</b>                                                                                                                |        |                                                |       |   |   |   |   |   |   |   |
| 1262 | Total Number of Observations                                                                                                             | 34     | Number of Distinct Observations                | 34    |   |   |   |   |   |   |   |
| 1263 |                                                                                                                                          |        | Number of Missing Observations                 | 0     |   |   |   |   |   |   |   |
| 1264 | Minimum                                                                                                                                  | 46.7   | Mean                                           | 1680  |   |   |   |   |   |   |   |
| 1265 | Maximum                                                                                                                                  | 18300  | Median                                         | 282   |   |   |   |   |   |   |   |
| 1266 | SD                                                                                                                                       | 3910   | Std. Error of Mean                             | 670.5 |   |   |   |   |   |   |   |
| 1267 | Coefficient of Variation                                                                                                                 | 2.327  | Skewness                                       | 3.4   |   |   |   |   |   |   |   |
| 1268 |                                                                                                                                          |        |                                                |       |   |   |   |   |   |   |   |
| 1269 | <b>Normal GOF Test</b>                                                                                                                   |        |                                                |       |   |   |   |   |   |   |   |
| 1270 | Shapiro Wilk Test Statistic                                                                                                              | 0.464  | <b>Shapiro Wilk GOF Test</b>                   |       |   |   |   |   |   |   |   |
| 1271 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.933  | Data Not Normal at 5% Significance Level       |       |   |   |   |   |   |   |   |
| 1272 | Lilliefors Test Statistic                                                                                                                | 0.363  | <b>Lilliefors GOF Test</b>                     |       |   |   |   |   |   |   |   |
| 1273 | 5% Lilliefors Critical Value                                                                                                             | 0.15   | Data Not Normal at 5% Significance Level       |       |   |   |   |   |   |   |   |

| A    | B                                                                                                                                       | C | D      | E     | F                                              | G                                                   | H | I | J     | K    | L |
|------|-----------------------------------------------------------------------------------------------------------------------------------------|---|--------|-------|------------------------------------------------|-----------------------------------------------------|---|---|-------|------|---|
| 1274 | <b>Data Not Normal at 5% Significance Level</b>                                                                                         |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1275 |                                                                                                                                         |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1276 | <b>Assuming Normal Distribution</b>                                                                                                     |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1277 | <b>95% Normal UCL</b>                                                                                                                   |   |        |       |                                                | <b>95% UCLs (Adjusted for Skewness)</b>             |   |   |       |      |   |
| 1278 | 95% Student's-t UCL                                                                                                                     |   | 2815   |       | 95% Adjusted-CLT UCL (Chen-1995)               |                                                     |   |   |       | 3201 |   |
| 1279 |                                                                                                                                         |   |        |       | 95% Modified-t UCL (Johnson-1978)              |                                                     |   |   |       | 2880 |   |
| 1280 |                                                                                                                                         |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1281 | <b>Gamma GOF Test</b>                                                                                                                   |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1282 | A-D Test Statistic                                                                                                                      |   |        | 2.984 |                                                | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |       |      |   |
| 1283 | 5% A-D Critical Value                                                                                                                   |   |        | 0.823 |                                                | Data Not Gamma Distributed at 5% Significance Level |   |   |       |      |   |
| 1284 | K-S Test Statistic                                                                                                                      |   |        | 0.261 |                                                | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |       |      |   |
| 1285 | 5% K-S Critical Value                                                                                                                   |   |        | 0.161 |                                                | Data Not Gamma Distributed at 5% Significance Level |   |   |       |      |   |
| 1286 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                              |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1287 |                                                                                                                                         |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1288 | <b>Gamma Statistics</b>                                                                                                                 |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1289 | k hat (MLE)                                                                                                                             |   | 0.447  |       | k star (bias corrected MLE)                    |                                                     |   |   | 0.427 |      |   |
| 1290 | Theta hat (MLE)                                                                                                                         |   | 3757   |       | Theta star (bias corrected MLE)                |                                                     |   |   | 3932  |      |   |
| 1291 | nu hat (MLE)                                                                                                                            |   | 30.4   |       | nu star (bias corrected)                       |                                                     |   |   | 29.05 |      |   |
| 1292 | MLE Mean (bias corrected)                                                                                                               |   | 1680   |       | MLE Sd (bias corrected)                        |                                                     |   |   | 2570  |      |   |
| 1293 |                                                                                                                                         |   |        |       | Approximate Chi Square Value (0.05)            |                                                     |   |   | 17.75 |      |   |
| 1294 | Adjusted Level of Significance                                                                                                          |   | 0.0422 |       | Adjusted Chi Square Value                      |                                                     |   |   | 17.31 |      |   |
| 1295 |                                                                                                                                         |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1296 | <b>Assuming Gamma Distribution</b>                                                                                                      |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1297 | 95% Approximate Gamma UCL (use when n>=50))                                                                                             |   |        | 2750  |                                                | 95% Adjusted Gamma UCL (use when n<50)              |   |   |       | 2819 |   |
| 1298 |                                                                                                                                         |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1299 | <b>Lognormal GOF Test</b>                                                                                                               |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1300 | Shapiro Wilk Test Statistic                                                                                                             |   | 0.917  |       | <b>Shapiro Wilk Lognormal GOF Test</b>         |                                                     |   |   |       |      |   |
| 1301 | 5% Shapiro Wilk Critical Value                                                                                                          |   | 0.933  |       | Data Not Lognormal at 5% Significance Level    |                                                     |   |   |       |      |   |
| 1302 | Lilliefors Test Statistic                                                                                                               |   | 0.121  |       | <b>Lilliefors Lognormal GOF Test</b>           |                                                     |   |   |       |      |   |
| 1303 | 5% Lilliefors Critical Value                                                                                                            |   | 0.15   |       | Data appear Lognormal at 5% Significance Level |                                                     |   |   |       |      |   |
| 1304 | <b>Data appear Approximate Lognormal at 5% Significance Level</b>                                                                       |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1305 |                                                                                                                                         |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1306 | <b>Lognormal Statistics</b>                                                                                                             |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1307 | Minimum of Logged Data                                                                                                                  |   | 3.844  |       | Mean of logged Data                            |                                                     |   |   | 5.981 |      |   |
| 1308 | Maximum of Logged Data                                                                                                                  |   | 9.815  |       | SD of logged Data                              |                                                     |   |   | 1.553 |      |   |
| 1309 |                                                                                                                                         |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1310 | <b>Assuming Lognormal Distribution</b>                                                                                                  |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1311 | 95% H-UCL                                                                                                                               |   | 3132   |       | 90% Chebyshev (MVUE) UCL                       |                                                     |   |   | 2498  |      |   |
| 1312 | 95% Chebyshev (MVUE) UCL                                                                                                                |   | 3073   |       | 97.5% Chebyshev (MVUE) UCL                     |                                                     |   |   | 3870  |      |   |
| 1313 | 99% Chebyshev (MVUE) UCL                                                                                                                |   | 5437   |       |                                                |                                                     |   |   |       |      |   |
| 1314 |                                                                                                                                         |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1315 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                   |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1316 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                        |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1317 |                                                                                                                                         |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1318 | <b>Nonparametric Distribution Free UCLs</b>                                                                                             |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1319 | 95% CLT UCL                                                                                                                             |   | 2783   |       | 95% Jackknife UCL                              |                                                     |   |   | 2815  |      |   |
| 1320 | 95% Standard Bootstrap UCL                                                                                                              |   | 2776   |       | 95% Bootstrap-t UCL                            |                                                     |   |   | 4586  |      |   |
| 1321 | 95% Hall's Bootstrap UCL                                                                                                                |   | 6577   |       | 95% Percentile Bootstrap UCL                   |                                                     |   |   | 2853  |      |   |
| 1322 | 95% BCA Bootstrap UCL                                                                                                                   |   | 3374   |       |                                                |                                                     |   |   |       |      |   |
| 1323 | 90% Chebyshev(Mean, Sd) UCL                                                                                                             |   | 3692   |       | 95% Chebyshev(Mean, Sd) UCL                    |                                                     |   |   | 4603  |      |   |
| 1324 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                           |   | 5867   |       | 99% Chebyshev(Mean, Sd) UCL                    |                                                     |   |   | 8352  |      |   |
| 1325 |                                                                                                                                         |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1326 | <b>Suggested UCL to Use</b>                                                                                                             |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1327 | 95% Chebyshev (Mean, Sd) UCL                                                                                                            |   | 4603   |       |                                                |                                                     |   |   |       |      |   |
| 1328 |                                                                                                                                         |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1329 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.            |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1330 | Recommendations are based upon data size, data distribution, and skewness.                                                              |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1331 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1332 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statisticia |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1333 |                                                                                                                                         |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1334 |                                                                                                                                         |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1335 | <b>Result (eu2_manganese_roadway)</b>                                                                                                   |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1336 |                                                                                                                                         |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1337 | <b>General Statistics</b>                                                                                                               |   |        |       |                                                |                                                     |   |   |       |      |   |
| 1338 | Total Number of Observations                                                                                                            |   | 34     |       | Number of Distinct Observations                |                                                     |   |   | 34    |      |   |
| 1339 |                                                                                                                                         |   |        |       | Number of Missing Observations                 |                                                     |   |   | 0     |      |   |
| 1340 | Minimum                                                                                                                                 |   | 477    |       | Mean                                           |                                                     |   |   | 1889  |      |   |

| A    | B | C | D | E                                                                                                                      | F      | G                                                               | H | I                                       | J | K                  | L     |
|------|---|---|---|------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------------------|---|-----------------------------------------|---|--------------------|-------|
| 1341 |   |   |   | Maximum                                                                                                                | 8990   |                                                                 |   |                                         |   | Median             | 1170  |
| 1342 |   |   |   | SD                                                                                                                     | 1891   |                                                                 |   |                                         |   | Std. Error of Mean | 324.3 |
| 1343 |   |   |   | Coefficient of Variation                                                                                               | 1.001  |                                                                 |   |                                         |   | Skewness           | 2.36  |
| 1344 |   |   |   | <b>Normal GOF Test</b>                                                                                                 |        |                                                                 |   |                                         |   |                    |       |
| 1345 |   |   |   | <b>Normal GOF Test</b>                                                                                                 |        |                                                                 |   |                                         |   |                    |       |
| 1346 |   |   |   | Shapiro Wilk Test Statistic                                                                                            | 0.706  | <b>Shapiro Wilk GOF Test</b>                                    |   |                                         |   |                    |       |
| 1347 |   |   |   | 5% Shapiro Wilk Critical Value                                                                                         | 0.933  | Data Not Normal at 5% Significance Level                        |   |                                         |   |                    |       |
| 1348 |   |   |   | Lilliefors Test Statistic                                                                                              | 0.233  | <b>Lilliefors GOF Test</b>                                      |   |                                         |   |                    |       |
| 1349 |   |   |   | 5% Lilliefors Critical Value                                                                                           | 0.15   | Data Not Normal at 5% Significance Level                        |   |                                         |   |                    |       |
| 1350 |   |   |   | <b>Data Not Normal at 5% Significance Level</b>                                                                        |        |                                                                 |   |                                         |   |                    |       |
| 1351 |   |   |   | <b>Assuming Normal Distribution</b>                                                                                    |        |                                                                 |   |                                         |   |                    |       |
| 1352 |   |   |   | <b>Assuming Normal Distribution</b>                                                                                    |        |                                                                 |   |                                         |   |                    |       |
| 1353 |   |   |   | <b>95% Normal UCL</b>                                                                                                  |        |                                                                 |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |                    |       |
| 1354 |   |   |   | 95% Student's-t UCL                                                                                                    | 2438   | 95% Adjusted-CLT UCL (Chen-1995)                                |   |                                         |   | 2563               |       |
| 1355 |   |   |   |                                                                                                                        |        | 95% Modified-t UCL (Johnson-1978)                               |   |                                         |   | 2460               |       |
| 1356 |   |   |   | <b>Gamma GOF Test</b>                                                                                                  |        |                                                                 |   |                                         |   |                    |       |
| 1357 |   |   |   | <b>Gamma GOF Test</b>                                                                                                  |        |                                                                 |   |                                         |   |                    |       |
| 1358 |   |   |   | A-D Test Statistic                                                                                                     | 1.425  | <b>Anderson-Darling Gamma GOF Test</b>                          |   |                                         |   |                    |       |
| 1359 |   |   |   | 5% A-D Critical Value                                                                                                  | 0.764  | Data Not Gamma Distributed at 5% Significance Level             |   |                                         |   |                    |       |
| 1360 |   |   |   | K-S Test Statistic                                                                                                     | 0.151  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |                                         |   |                    |       |
| 1361 |   |   |   | 5% K-S Critical Value                                                                                                  | 0.153  | Detected data appear Gamma Distributed at 5% Significance Level |   |                                         |   |                    |       |
| 1362 |   |   |   | <b>Detected data follow Appr. Gamma Distribution at 5% Significance Level</b>                                          |        |                                                                 |   |                                         |   |                    |       |
| 1363 |   |   |   | <b>Gamma Statistics</b>                                                                                                |        |                                                                 |   |                                         |   |                    |       |
| 1364 |   |   |   | <b>Gamma Statistics</b>                                                                                                |        |                                                                 |   |                                         |   |                    |       |
| 1365 |   |   |   | k hat (MLE)                                                                                                            | 1.668  | k star (bias corrected MLE)                                     |   |                                         |   | 1.541              |       |
| 1366 |   |   |   | Theta hat (MLE)                                                                                                        | 1132   | Theta star (bias corrected MLE)                                 |   |                                         |   | 1226               |       |
| 1367 |   |   |   | nu hat (MLE)                                                                                                           | 113.5  | nu star (bias corrected)                                        |   |                                         |   | 104.8              |       |
| 1368 |   |   |   | MLE Mean (bias corrected)                                                                                              | 1889   | MLE Sd (bias corrected)                                         |   |                                         |   | 1522               |       |
| 1369 |   |   |   |                                                                                                                        |        | Approximate Chi Square Value (0.05)                             |   |                                         |   | 82.16              |       |
| 1370 |   |   |   | Adjusted Level of Significance                                                                                         | 0.0422 | Adjusted Chi Square Value                                       |   |                                         |   | 81.17              |       |
| 1371 |   |   |   | <b>Assuming Gamma Distribution</b>                                                                                     |        |                                                                 |   |                                         |   |                    |       |
| 1372 |   |   |   | <b>Assuming Gamma Distribution</b>                                                                                     |        |                                                                 |   |                                         |   |                    |       |
| 1373 |   |   |   | 95% Approximate Gamma UCL (use when n>=50)                                                                             | 2409   | 95% Adjusted Gamma UCL (use when n<50)                          |   |                                         |   | 2439               |       |
| 1374 |   |   |   | <b>Lognormal GOF Test</b>                                                                                              |        |                                                                 |   |                                         |   |                    |       |
| 1375 |   |   |   | <b>Lognormal GOF Test</b>                                                                                              |        |                                                                 |   |                                         |   |                    |       |
| 1376 |   |   |   | Shapiro Wilk Test Statistic                                                                                            | 0.929  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |                                         |   |                    |       |
| 1377 |   |   |   | 5% Shapiro Wilk Critical Value                                                                                         | 0.933  | Data Not Lognormal at 5% Significance Level                     |   |                                         |   |                    |       |
| 1378 |   |   |   | Lilliefors Test Statistic                                                                                              | 0.143  | <b>Lilliefors Lognormal GOF Test</b>                            |   |                                         |   |                    |       |
| 1379 |   |   |   | 5% Lilliefors Critical Value                                                                                           | 0.15   | Data appear Lognormal at 5% Significance Level                  |   |                                         |   |                    |       |
| 1380 |   |   |   | <b>Data appear Approximate Lognormal at 5% Significance Level</b>                                                      |        |                                                                 |   |                                         |   |                    |       |
| 1381 |   |   |   | <b>Lognormal Statistics</b>                                                                                            |        |                                                                 |   |                                         |   |                    |       |
| 1382 |   |   |   | <b>Lognormal Statistics</b>                                                                                            |        |                                                                 |   |                                         |   |                    |       |
| 1383 |   |   |   | Minimum of Logged Data                                                                                                 | 6.168  | Mean of logged Data                                             |   |                                         |   | 7.215              |       |
| 1384 |   |   |   | Maximum of Logged Data                                                                                                 | 9.104  | SD of logged Data                                               |   |                                         |   | 0.766              |       |
| 1385 |   |   |   | <b>Assuming Lognormal Distribution</b>                                                                                 |        |                                                                 |   |                                         |   |                    |       |
| 1386 |   |   |   | <b>Assuming Lognormal Distribution</b>                                                                                 |        |                                                                 |   |                                         |   |                    |       |
| 1387 |   |   |   | 95% H-UCL                                                                                                              | 2442   | 90% Chebyshev (MVUE) UCL                                        |   |                                         |   | 2587               |       |
| 1388 |   |   |   | 95% Chebyshev (MVUE) UCL                                                                                               | 2942   | 97.5% Chebyshev (MVUE) UCL                                      |   |                                         |   | 3434               |       |
| 1389 |   |   |   | 99% Chebyshev (MVUE) UCL                                                                                               | 4400   |                                                                 |   |                                         |   |                    |       |
| 1390 |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                  |        |                                                                 |   |                                         |   |                    |       |
| 1391 |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                  |        |                                                                 |   |                                         |   |                    |       |
| 1392 |   |   |   | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                       |        |                                                                 |   |                                         |   |                    |       |
| 1393 |   |   |   | <b>Nonparametric Distribution Free UCLs</b>                                                                            |        |                                                                 |   |                                         |   |                    |       |
| 1394 |   |   |   | <b>Nonparametric Distribution Free UCLs</b>                                                                            |        |                                                                 |   |                                         |   |                    |       |
| 1395 |   |   |   | 95% CLT UCL                                                                                                            | 2423   | 95% Jackknife UCL                                               |   |                                         |   | 2438               |       |
| 1396 |   |   |   | 95% Standard Bootstrap UCL                                                                                             | 2413   | 95% Bootstrap-t UCL                                             |   |                                         |   | 2753               |       |
| 1397 |   |   |   | 95% Hall's Bootstrap UCL                                                                                               | 2829   | 95% Percentile Bootstrap UCL                                    |   |                                         |   | 2433               |       |
| 1398 |   |   |   | 95% BCA Bootstrap UCL                                                                                                  | 2537   |                                                                 |   |                                         |   |                    |       |
| 1399 |   |   |   | 90% Chebyshev(Mean, Sd) UCL                                                                                            | 2862   | 95% Chebyshev(Mean, Sd) UCL                                     |   |                                         |   | 3303               |       |
| 1400 |   |   |   | 97.5% Chebyshev(Mean, Sd) UCL                                                                                          | 3915   | 99% Chebyshev(Mean, Sd) UCL                                     |   |                                         |   | 5116               |       |
| 1401 |   |   |   | <b>Suggested UCL to Use</b>                                                                                            |        |                                                                 |   |                                         |   |                    |       |
| 1402 |   |   |   | <b>Suggested UCL to Use</b>                                                                                            |        |                                                                 |   |                                         |   |                    |       |
| 1403 |   |   |   | 95% Adjusted Gamma UCL                                                                                                 | 2439   |                                                                 |   |                                         |   |                    |       |
| 1404 |   |   |   | <b>Suggested UCL to Use</b>                                                                                            |        |                                                                 |   |                                         |   |                    |       |
| 1405 |   |   |   | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                         |        |                                                                 |   |                                         |   |                    |       |
| 1406 |   |   |   | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL |        |                                                                 |   |                                         |   |                    |       |
| 1407 |   |   |   | <b>Suggested UCL to Use</b>                                                                                            |        |                                                                 |   |                                         |   |                    |       |

| A    | B                                                                                                                                        | C      | D                                                            | E | F      | G | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------------------------------------------------------|---|--------|---|---|---|---|---|---|
| 1408 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |                                                              |   |        |   |   |   |   |   |   |
| 1409 | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |                                                              |   |        |   |   |   |   |   |   |
| 1410 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |                                                              |   |        |   |   |   |   |   |   |
| 1411 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |                                                              |   |        |   |   |   |   |   |   |
| 1412 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 1413 | <b>Result (eu2_thallium_roadway)</b>                                                                                                     |        |                                                              |   |        |   |   |   |   |   |   |
| 1414 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 1415 | <b>General Statistics</b>                                                                                                                |        |                                                              |   |        |   |   |   |   |   |   |
| 1416 | Total Number of Observations                                                                                                             | 34     | Number of Distinct Observations                              |   | 22     |   |   |   |   |   |   |
| 1417 | Number of Detects                                                                                                                        | 25     | Number of Non-Detects                                        |   | 9      |   |   |   |   |   |   |
| 1418 | Number of Distinct Detects                                                                                                               | 16     | Number of Distinct Non-Detects                               |   | 6      |   |   |   |   |   |   |
| 1419 | Minimum Detect                                                                                                                           | 0.06   | Minimum Non-Detect                                           |   | 0.497  |   |   |   |   |   |   |
| 1420 | Maximum Detect                                                                                                                           | 0.95   | Maximum Non-Detect                                           |   | 0.506  |   |   |   |   |   |   |
| 1421 | Variance Detects                                                                                                                         | 0.0286 | Percent Non-Detects                                          |   | 26.47% |   |   |   |   |   |   |
| 1422 | Mean Detects                                                                                                                             | 0.186  | SD Detects                                                   |   | 0.169  |   |   |   |   |   |   |
| 1423 | Median Detects                                                                                                                           | 0.15   | CV Detects                                                   |   | 0.907  |   |   |   |   |   |   |
| 1424 | Skewness Detects                                                                                                                         | 4.09   | Kurtosis Detects                                             |   | 18.84  |   |   |   |   |   |   |
| 1425 | Mean of Logged Detects                                                                                                                   | -1.869 | SD of Logged Detects                                         |   | 0.557  |   |   |   |   |   |   |
| 1426 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 1427 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |        |                                                              |   |        |   |   |   |   |   |   |
| 1428 | Shapiro Wilk Test Statistic                                                                                                              | 0.523  | <b>Shapiro Wilk GOF Test</b>                                 |   |        |   |   |   |   |   |   |
| 1429 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.918  | Detected Data Not Normal at 5% Significance Level            |   |        |   |   |   |   |   |   |
| 1430 | Lilliefors Test Statistic                                                                                                                | 0.301  | <b>Lilliefors GOF Test</b>                                   |   |        |   |   |   |   |   |   |
| 1431 | 5% Lilliefors Critical Value                                                                                                             | 0.173  | Detected Data Not Normal at 5% Significance Level            |   |        |   |   |   |   |   |   |
| 1432 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |        |                                                              |   |        |   |   |   |   |   |   |
| 1433 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 1434 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |        |                                                              |   |        |   |   |   |   |   |   |
| 1435 | KM Mean                                                                                                                                  | 0.178  | KM Standard Error of Mean                                    |   | 0.0263 |   |   |   |   |   |   |
| 1436 | KM SD                                                                                                                                    | 0.146  | 95% KM (BCA) UCL                                             |   | 0.221  |   |   |   |   |   |   |
| 1437 | 95% KM (t) UCL                                                                                                                           | 0.222  | 95% KM (Percentile Bootstrap) UCL                            |   | 0.223  |   |   |   |   |   |   |
| 1438 | 95% KM (z) UCL                                                                                                                           | 0.221  | 95% KM Bootstrap t UCL                                       |   | 0.268  |   |   |   |   |   |   |
| 1439 | 90% KM Chebyshev UCL                                                                                                                     | 0.257  | 95% KM Chebyshev UCL                                         |   | 0.292  |   |   |   |   |   |   |
| 1440 | 97.5% KM Chebyshev UCL                                                                                                                   | 0.342  | 99% KM Chebyshev UCL                                         |   | 0.439  |   |   |   |   |   |   |
| 1441 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 1442 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |        |                                                              |   |        |   |   |   |   |   |   |
| 1443 | A-D Test Statistic                                                                                                                       | 1.186  | <b>Anderson-Darling GOF Test</b>                             |   |        |   |   |   |   |   |   |
| 1444 | 5% A-D Critical Value                                                                                                                    | 0.752  | Detected Data Not Gamma Distributed at 5% Significance Level |   |        |   |   |   |   |   |   |
| 1445 | K-S Test Statistic                                                                                                                       | 0.195  | <b>Kolmogorov-Smimov GOF</b>                                 |   |        |   |   |   |   |   |   |
| 1446 | 5% K-S Critical Value                                                                                                                    | 0.176  | Detected Data Not Gamma Distributed at 5% Significance Level |   |        |   |   |   |   |   |   |
| 1447 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                                      |        |                                                              |   |        |   |   |   |   |   |   |
| 1448 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 1449 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |        |                                                              |   |        |   |   |   |   |   |   |
| 1450 | k hat (MLE)                                                                                                                              | 2.799  | k star (bias corrected MLE)                                  |   | 2.49   |   |   |   |   |   |   |
| 1451 | Theta hat (MLE)                                                                                                                          | 0.0666 | Theta star (bias corrected MLE)                              |   | 0.0749 |   |   |   |   |   |   |
| 1452 | nu hat (MLE)                                                                                                                             | 139.9  | nu star (bias corrected)                                     |   | 124.5  |   |   |   |   |   |   |
| 1453 | Mean (detects)                                                                                                                           | 0.186  |                                                              |   |        |   |   |   |   |   |   |
| 1454 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 1455 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |        |                                                              |   |        |   |   |   |   |   |   |
| 1456 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |        |                                                              |   |        |   |   |   |   |   |   |
| 1457 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |        |                                                              |   |        |   |   |   |   |   |   |
| 1458 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |        |                                                              |   |        |   |   |   |   |   |   |
| 1459 | This is especially true when the sample size is small.                                                                                   |        |                                                              |   |        |   |   |   |   |   |   |
| 1460 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |        |                                                              |   |        |   |   |   |   |   |   |
| 1461 | Minimum                                                                                                                                  | 0.06   | Mean                                                         |   | 0.178  |   |   |   |   |   |   |
| 1462 | Maximum                                                                                                                                  | 0.95   | Median                                                       |   | 0.152  |   |   |   |   |   |   |
| 1463 | SD                                                                                                                                       | 0.147  | CV                                                           |   | 0.824  |   |   |   |   |   |   |
| 1464 | k hat (MLE)                                                                                                                              | 3.403  | k star (bias corrected MLE)                                  |   | 3.122  |   |   |   |   |   |   |
| 1465 | Theta hat (MLE)                                                                                                                          | 0.0524 | Theta star (bias corrected MLE)                              |   | 0.0571 |   |   |   |   |   |   |
| 1466 | nu hat (MLE)                                                                                                                             | 231.4  | nu star (bias corrected)                                     |   | 212.3  |   |   |   |   |   |   |
| 1467 | Adjusted Level of Significance ( $\beta$ )                                                                                               | 0.0422 |                                                              |   |        |   |   |   |   |   |   |
| 1468 | Approximate Chi Square Value (212.32, $\alpha$ )                                                                                         | 179.6  | Adjusted Chi Square Value (212.32, $\beta$ )                 |   | 178.1  |   |   |   |   |   |   |
| 1469 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                                        | 0.211  | 95% Gamma Adjusted UCL (use when $n < 50$ )                  |   | 0.212  |   |   |   |   |   |   |
| 1470 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 1471 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |        |                                                              |   |        |   |   |   |   |   |   |
| 1472 | Mean (KM)                                                                                                                                | 0.178  | SD (KM)                                                      |   | 0.146  |   |   |   |   |   |   |
| 1473 | Variance (KM)                                                                                                                            | 0.0213 | SE of Mean (KM)                                              |   | 0.0263 |   |   |   |   |   |   |
| 1474 | k hat (KM)                                                                                                                               | 1.489  | k star (KM)                                                  |   | 1.378  |   |   |   |   |   |   |

|      | A | B | C | D | E                                                                                                                                        | F      | G | H                           | I | J | K                                                       | L      |
|------|---|---|---|---|------------------------------------------------------------------------------------------------------------------------------------------|--------|---|-----------------------------|---|---|---------------------------------------------------------|--------|
| 1475 |   |   |   |   | nu hat (KM)                                                                                                                              | 101.3  |   |                             |   |   | nu star (KM)                                            | 93.68  |
| 1476 |   |   |   |   | theta hat (KM)                                                                                                                           | 0.12   |   |                             |   |   | theta star (KM)                                         | 0.129  |
| 1477 |   |   |   |   | 80% gamma percentile (KM)                                                                                                                | 0.278  |   |                             |   |   | 90% gamma percentile (KM)                               | 0.379  |
| 1478 |   |   |   |   | 95% gamma percentile (KM)                                                                                                                | 0.477  |   |                             |   |   | 99% gamma percentile (KM)                               | 0.701  |
| 1479 |   |   |   |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |        |   |                             |   |   |                                                         |        |
| 1480 |   |   |   |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |        |   |                             |   |   |                                                         |        |
| 1481 |   |   |   |   | Approximate Chi Square Value (93.68, $\alpha$ )                                                                                          | 72.36  |   |                             |   |   | Adjusted Chi Square Value (93.68, $\beta$ )             | 71.43  |
| 1482 |   |   |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                      | 0.231  |   |                             |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )          | 0.234  |
| 1483 |   |   |   |   |                                                                                                                                          |        |   |                             |   |   |                                                         |        |
| 1484 |   |   |   |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |        |   |                             |   |   |                                                         |        |
| 1485 |   |   |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.907  |   |                             |   |   | <b>Shapiro Wilk GOF Test</b>                            |        |
| 1486 |   |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                           | 0.918  |   |                             |   |   | Detected Data Not Lognormal at 5% Significance Level    |        |
| 1487 |   |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.142  |   |                             |   |   | <b>Lilliefors GOF Test</b>                              |        |
| 1488 |   |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.173  |   |                             |   |   | Detected Data appear Lognormal at 5% Significance Level |        |
| 1489 |   |   |   |   | <b>Detected Data appear Approximate Lognormal at 5% Significance Level</b>                                                               |        |   |                             |   |   |                                                         |        |
| 1490 |   |   |   |   |                                                                                                                                          |        |   |                             |   |   |                                                         |        |
| 1491 |   |   |   |   | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |        |   |                             |   |   |                                                         |        |
| 1492 |   |   |   |   | Mean in Original Scale                                                                                                                   | 0.177  |   |                             |   |   | Mean in Log Scale                                       | -1.879 |
| 1493 |   |   |   |   | SD in Original Scale                                                                                                                     | 0.146  |   |                             |   |   | SD in Log Scale                                         | 0.486  |
| 1494 |   |   |   |   | 95% t UCL (assumes normality of ROS data)                                                                                                | 0.219  |   |                             |   |   | 95% Percentile Bootstrap UCL                            | 0.224  |
| 1495 |   |   |   |   | 95% BCA Bootstrap UCL                                                                                                                    | 0.248  |   |                             |   |   | 95% Bootstrap t UCL                                     | 0.278  |
| 1496 |   |   |   |   | 95% H-UCL (Log ROS)                                                                                                                      | 0.202  |   |                             |   |   |                                                         |        |
| 1497 |   |   |   |   |                                                                                                                                          |        |   |                             |   |   |                                                         |        |
| 1498 |   |   |   |   | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |        |   |                             |   |   |                                                         |        |
| 1499 |   |   |   |   | KM Mean (logged)                                                                                                                         | -1.889 |   |                             |   |   | KM Geo Mean                                             | 0.151  |
| 1500 |   |   |   |   | KM SD (logged)                                                                                                                           | 0.514  |   |                             |   |   | 95% Critical H Value (KM-Log)                           | 1.95   |
| 1501 |   |   |   |   | KM Standard Error of Mean (logged)                                                                                                       | 0.0998 |   |                             |   |   | 95% H-UCL (KM -Log)                                     | 0.206  |
| 1502 |   |   |   |   | KM SD (logged)                                                                                                                           | 0.514  |   |                             |   |   | 95% Critical H Value (KM-Log)                           | 1.95   |
| 1503 |   |   |   |   | KM Standard Error of Mean (logged)                                                                                                       | 0.0998 |   |                             |   |   |                                                         |        |
| 1504 |   |   |   |   |                                                                                                                                          |        |   |                             |   |   |                                                         |        |
| 1505 |   |   |   |   | <b>DL/2 Statistics</b>                                                                                                                   |        |   |                             |   |   |                                                         |        |
| 1506 |   |   |   |   | <b>DL/2 Normal</b>                                                                                                                       |        |   | <b>DL/2 Log-Transformed</b> |   |   |                                                         |        |
| 1507 |   |   |   |   | Mean in Original Scale                                                                                                                   | 0.204  |   |                             |   |   | Mean in Log Scale                                       | -1.74  |
| 1508 |   |   |   |   | SD in Original Scale                                                                                                                     | 0.147  |   |                             |   |   | SD in Log Scale                                         | 0.522  |
| 1509 |   |   |   |   | 95% t UCL (Assumes normality)                                                                                                            | 0.246  |   |                             |   |   | 95% H-Stat UCL                                          | 0.24   |
| 1510 |   |   |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |        |   |                             |   |   |                                                         |        |
| 1511 |   |   |   |   |                                                                                                                                          |        |   |                             |   |   |                                                         |        |
| 1512 |   |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |   |                             |   |   |                                                         |        |
| 1513 |   |   |   |   | <b>Detected Data appear Approximate Lognormal Distributed at 5% Significance Level</b>                                                   |        |   |                             |   |   |                                                         |        |
| 1514 |   |   |   |   |                                                                                                                                          |        |   |                             |   |   |                                                         |        |
| 1515 |   |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |        |   |                             |   |   |                                                         |        |
| 1516 |   |   |   |   | KM H-UCL                                                                                                                                 | 0.206  |   |                             |   |   |                                                         |        |
| 1517 |   |   |   |   |                                                                                                                                          |        |   |                             |   |   |                                                         |        |
| 1518 |   |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |   |                             |   |   |                                                         |        |
| 1519 |   |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |   |                             |   |   |                                                         |        |
| 1520 |   |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |   |                             |   |   |                                                         |        |
| 1521 |   |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |   |                             |   |   |                                                         |        |
| 1522 |   |   |   |   |                                                                                                                                          |        |   |                             |   |   |                                                         |        |
| 1523 |   |   |   |   |                                                                                                                                          |        |   |                             |   |   |                                                         |        |
| 1524 |   |   |   |   | <b>Result (eu2_zinc_roadway)</b>                                                                                                         |        |   |                             |   |   |                                                         |        |
| 1525 |   |   |   |   |                                                                                                                                          |        |   |                             |   |   |                                                         |        |
| 1526 |   |   |   |   | <b>General Statistics</b>                                                                                                                |        |   |                             |   |   |                                                         |        |
| 1527 |   |   |   |   | Total Number of Observations                                                                                                             | 34     |   |                             |   |   | Number of Distinct Observations                         | 34     |
| 1528 |   |   |   |   |                                                                                                                                          |        |   |                             |   |   | Number of Missing Observations                          | 0      |
| 1529 |   |   |   |   | Minimum                                                                                                                                  | 166    |   |                             |   |   | Mean                                                    | 950.3  |
| 1530 |   |   |   |   | Maximum                                                                                                                                  | 5480   |   |                             |   |   | Median                                                  | 348    |
| 1531 |   |   |   |   | SD                                                                                                                                       | 1381   |   |                             |   |   | Std. Error of Mean                                      | 236.9  |
| 1532 |   |   |   |   | Coefficient of Variation                                                                                                                 | 1.454  |   |                             |   |   | Skewness                                                | 2.357  |
| 1533 |   |   |   |   |                                                                                                                                          |        |   |                             |   |   |                                                         |        |
| 1534 |   |   |   |   | <b>Normal GOF Test</b>                                                                                                                   |        |   |                             |   |   |                                                         |        |
| 1535 |   |   |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.604  |   |                             |   |   | <b>Shapiro Wilk GOF Test</b>                            |        |
| 1536 |   |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                           | 0.933  |   |                             |   |   | Data Not Normal at 5% Significance Level                |        |
| 1537 |   |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.312  |   |                             |   |   | <b>Lilliefors GOF Test</b>                              |        |
| 1538 |   |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.15   |   |                             |   |   | Data Not Normal at 5% Significance Level                |        |
| 1539 |   |   |   |   | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |        |   |                             |   |   |                                                         |        |
| 1540 |   |   |   |   |                                                                                                                                          |        |   |                             |   |   |                                                         |        |
| 1541 |   |   |   |   | <b>Assuming Normal Distribution</b>                                                                                                      |        |   |                             |   |   |                                                         |        |

|      | A                                                                                                                                        | B | C | D | E      | F | G                                                   | H | I | J | K     | L |      |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|--------|---|-----------------------------------------------------|---|---|---|-------|---|------|
| 1542 | <b>95% Normal UCL</b>                                                                                                                    |   |   |   |        |   | <b>95% UCLs (Adjusted for Skewness)</b>             |   |   |   |       |   |      |
| 1543 | 95% Student's-t UCL                                                                                                                      |   |   |   | 1351   |   | 95% Adjusted-CLT UCL (Chen-1995)                    |   |   |   | 1442  |   |      |
| 1544 |                                                                                                                                          |   |   |   |        |   | 95% Modified-t UCL (Johnson-1978)                   |   |   |   |       |   | 1367 |
| 1545 |                                                                                                                                          |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1546 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1547 | A-D Test Statistic                                                                                                                       |   |   |   | 2.885  |   | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |   |       |   |      |
| 1548 | 5% A-D Critical Value                                                                                                                    |   |   |   | 0.781  |   | Data Not Gamma Distributed at 5% Significance Level |   |   |   |       |   |      |
| 1549 | K-S Test Statistic                                                                                                                       |   |   |   | 0.219  |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |   |       |   |      |
| 1550 | 5% K-S Critical Value                                                                                                                    |   |   |   | 0.156  |   | Data Not Gamma Distributed at 5% Significance Level |   |   |   |       |   |      |
| 1551 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1552 |                                                                                                                                          |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1553 | <b>Gamma Statistics</b>                                                                                                                  |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1554 | k hat (MLE)                                                                                                                              |   |   |   | 0.893  |   | k star (bias corrected MLE)                         |   |   |   | 0.834 |   |      |
| 1555 | Theta hat (MLE)                                                                                                                          |   |   |   | 1064   |   | Theta star (bias corrected MLE)                     |   |   |   | 1140  |   |      |
| 1556 | nu hat (MLE)                                                                                                                             |   |   |   | 60.7   |   | nu star (bias corrected)                            |   |   |   | 56.68 |   |      |
| 1557 | MLE Mean (bias corrected)                                                                                                                |   |   |   | 950.3  |   | MLE Sd (bias corrected)                             |   |   |   | 1041  |   |      |
| 1558 |                                                                                                                                          |   |   |   |        |   | Approximate Chi Square Value (0.05)                 |   |   |   | 40.38 |   |      |
| 1559 | Adjusted Level of Significance                                                                                                           |   |   |   | 0.0422 |   | Adjusted Chi Square Value                           |   |   |   | 39.69 |   |      |
| 1560 |                                                                                                                                          |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1561 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1562 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |   |   | 1334   |   | 95% Adjusted Gamma UCL (use when n<50)              |   |   |   | 1357  |   |      |
| 1563 |                                                                                                                                          |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1564 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1565 | Shapiro Wilk Test Statistic                                                                                                              |   |   |   | 0.85   |   | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |   |   |       |   |      |
| 1566 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   |   | 0.933  |   | Data Not Lognormal at 5% Significance Level         |   |   |   |       |   |      |
| 1567 | Lilliefors Test Statistic                                                                                                                |   |   |   | 0.176  |   | <b>Lilliefors Lognormal GOF Test</b>                |   |   |   |       |   |      |
| 1568 | 5% Lilliefors Critical Value                                                                                                             |   |   |   | 0.15   |   | Data Not Lognormal at 5% Significance Level         |   |   |   |       |   |      |
| 1569 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1570 |                                                                                                                                          |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1571 | <b>Lognormal Statistics</b>                                                                                                              |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1572 | Minimum of Logged Data                                                                                                                   |   |   |   | 5.112  |   | Mean of logged Data                                 |   |   |   | 6.201 |   |      |
| 1573 | Maximum of Logged Data                                                                                                                   |   |   |   | 8.609  |   | SD of logged Data                                   |   |   |   | 1.046 |   |      |
| 1574 |                                                                                                                                          |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1575 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1576 | 95% H-UCL                                                                                                                                |   |   |   | 1345   |   | 90% Chebyshev (MVUE) UCL                            |   |   |   | 1356  |   |      |
| 1577 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   |   | 1593   |   | 97.5% Chebyshev (MVUE) UCL                          |   |   |   | 1923  |   |      |
| 1578 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   |   | 2569   |   |                                                     |   |   |   |       |   |      |
| 1579 |                                                                                                                                          |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1580 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1581 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1582 |                                                                                                                                          |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1583 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1584 | 95% CLT UCL                                                                                                                              |   |   |   | 1340   |   | 95% Jackknife UCL                                   |   |   |   | 1351  |   |      |
| 1585 | 95% Standard Bootstrap UCL                                                                                                               |   |   |   | 1343   |   | 95% Bootstrap-t UCL                                 |   |   |   | 1583  |   |      |
| 1586 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   |   | 1427   |   | 95% Percentile Bootstrap UCL                        |   |   |   | 1379  |   |      |
| 1587 | 95% BCA Bootstrap UCL                                                                                                                    |   |   |   | 1495   |   |                                                     |   |   |   |       |   |      |
| 1588 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   |   | 1661   |   | 95% Chebyshev(Mean, Sd) UCL                         |   |   |   | 1983  |   |      |
| 1589 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   |   | 2430   |   | 99% Chebyshev(Mean, Sd) UCL                         |   |   |   | 3307  |   |      |
| 1590 |                                                                                                                                          |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1591 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1592 | 95% Chebyshev (Mean, Sd) UCL                                                                                                             |   |   |   | 1983   |   |                                                     |   |   |   |       |   |      |
| 1593 |                                                                                                                                          |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1594 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1595 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1596 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1597 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1598 |                                                                                                                                          |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1599 |                                                                                                                                          |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1600 | <b>Result (eu3_antimony_roadway)</b>                                                                                                     |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1601 |                                                                                                                                          |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1602 | <b>General Statistics</b>                                                                                                                |   |   |   |        |   |                                                     |   |   |   |       |   |      |
| 1603 | Total Number of Observations                                                                                                             |   |   |   | 9      |   | Number of Distinct Observations                     |   |   |   | 9     |   |      |
| 1604 |                                                                                                                                          |   |   |   |        |   | Number of Missing Observations                      |   |   |   | 0     |   |      |
| 1605 | Minimum                                                                                                                                  |   |   |   | 0.36   |   | Mean                                                |   |   |   | 1.261 |   |      |
| 1606 | Maximum                                                                                                                                  |   |   |   | 2.5    |   | Median                                              |   |   |   | 0.89  |   |      |
| 1607 | SD                                                                                                                                       |   |   |   | 0.761  |   | Std. Error of Mean                                  |   |   |   | 0.254 |   |      |
| 1608 | Coefficient of Variation                                                                                                                 |   |   |   | 0.603  |   | Skewness                                            |   |   |   | 0.635 |   |      |

| A    | B                                                                                                                                   | C      | D                                                               | E | F                                       | G | H      | I | J | K | L |
|------|-------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------------------|---|-----------------------------------------|---|--------|---|---|---|---|
| 1609 |                                                                                                                                     |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1610 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                          |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1611 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                              |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1612 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                 |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1613 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                      |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1614 |                                                                                                                                     |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1615 | <b>Normal GOF Test</b>                                                                                                              |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1616 | Shapiro Wilk Test Statistic                                                                                                         | 0.898  | <b>Shapiro Wilk GOF Test</b>                                    |   |                                         |   |        |   |   |   |   |
| 1617 | 5% Shapiro Wilk Critical Value                                                                                                      | 0.829  | Data appear Normal at 5% Significance Level                     |   |                                         |   |        |   |   |   |   |
| 1618 | Lilliefors Test Statistic                                                                                                           | 0.243  | <b>Lilliefors GOF Test</b>                                      |   |                                         |   |        |   |   |   |   |
| 1619 | 5% Lilliefors Critical Value                                                                                                        | 0.274  | Data appear Normal at 5% Significance Level                     |   |                                         |   |        |   |   |   |   |
| 1620 | <b>Data appear Normal at 5% Significance Level</b>                                                                                  |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1621 |                                                                                                                                     |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1622 | <b>Assuming Normal Distribution</b>                                                                                                 |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1623 | <b>95% Normal UCL</b>                                                                                                               |        |                                                                 |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |        |   |   |   |   |
| 1624 | 95% Student's-t UCL                                                                                                                 | 1.733  | 95% Adjusted-CLT UCL (Chen-1995)                                |   |                                         |   | 1.736  |   |   |   |   |
| 1625 |                                                                                                                                     |        | 95% Modified-t UCL (Johnson-1978)                               |   |                                         |   | 1.742  |   |   |   |   |
| 1626 |                                                                                                                                     |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1627 | <b>Gamma GOF Test</b>                                                                                                               |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1628 | A-D Test Statistic                                                                                                                  | 0.33   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |                                         |   |        |   |   |   |   |
| 1629 | 5% A-D Critical Value                                                                                                               | 0.727  | Detected data appear Gamma Distributed at 5% Significance Level |   |                                         |   |        |   |   |   |   |
| 1630 | K-S Test Statistic                                                                                                                  | 0.202  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |                                         |   |        |   |   |   |   |
| 1631 | 5% K-S Critical Value                                                                                                               | 0.281  | Detected data appear Gamma Distributed at 5% Significance Level |   |                                         |   |        |   |   |   |   |
| 1632 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                              |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1633 |                                                                                                                                     |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1634 | <b>Gamma Statistics</b>                                                                                                             |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1635 | k hat (MLE)                                                                                                                         | 3.035  | k star (bias corrected MLE)                                     |   |                                         |   | 2.098  |   |   |   |   |
| 1636 | Theta hat (MLE)                                                                                                                     | 0.415  | Theta star (bias corrected MLE)                                 |   |                                         |   | 0.601  |   |   |   |   |
| 1637 | nu hat (MLE)                                                                                                                        | 54.64  | nu star (bias corrected)                                        |   |                                         |   | 37.76  |   |   |   |   |
| 1638 | MLE Mean (bias corrected)                                                                                                           | 1.261  | MLE Sd (bias corrected)                                         |   |                                         |   | 0.871  |   |   |   |   |
| 1639 |                                                                                                                                     |        | Approximate Chi Square Value (0.05)                             |   |                                         |   | 24.69  |   |   |   |   |
| 1640 | Adjusted Level of Significance                                                                                                      | 0.0231 | Adjusted Chi Square Value                                       |   |                                         |   | 22.48  |   |   |   |   |
| 1641 |                                                                                                                                     |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1642 | <b>Assuming Gamma Distribution</b>                                                                                                  |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1643 | 95% Approximate Gamma UCL (use when n>=50))                                                                                         | 1.929  | 95% Adjusted Gamma UCL (use when n<50)                          |   |                                         |   | 2.118  |   |   |   |   |
| 1644 |                                                                                                                                     |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1645 | <b>Lognormal GOF Test</b>                                                                                                           |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1646 | Shapiro Wilk Test Statistic                                                                                                         | 0.948  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |                                         |   |        |   |   |   |   |
| 1647 | 5% Shapiro Wilk Critical Value                                                                                                      | 0.829  | Data appear Lognormal at 5% Significance Level                  |   |                                         |   |        |   |   |   |   |
| 1648 | Lilliefors Test Statistic                                                                                                           | 0.163  | <b>Lilliefors Lognormal GOF Test</b>                            |   |                                         |   |        |   |   |   |   |
| 1649 | 5% Lilliefors Critical Value                                                                                                        | 0.274  | Data appear Lognormal at 5% Significance Level                  |   |                                         |   |        |   |   |   |   |
| 1650 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                               |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1651 |                                                                                                                                     |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1652 | <b>Lognormal Statistics</b>                                                                                                         |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1653 | Minimum of Logged Data                                                                                                              | -1.022 | Mean of logged Data                                             |   |                                         |   | 0.0583 |   |   |   |   |
| 1654 | Maximum of Logged Data                                                                                                              | 0.916  | SD of logged Data                                               |   |                                         |   | 0.642  |   |   |   |   |
| 1655 |                                                                                                                                     |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1656 | <b>Assuming Lognormal Distribution</b>                                                                                              |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1657 | 95% H-UCL                                                                                                                           | 2.307  | 90% Chebyshev (MVUE) UCL                                        |   |                                         |   | 2.101  |   |   |   |   |
| 1658 | 95% Chebyshev (MVUE) UCL                                                                                                            | 2.478  | 97.5% Chebyshev (MVUE) UCL                                      |   |                                         |   | 3.001  |   |   |   |   |
| 1659 | 99% Chebyshev (MVUE) UCL                                                                                                            | 4.029  |                                                                 |   |                                         |   |        |   |   |   |   |
| 1660 |                                                                                                                                     |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1661 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                               |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1662 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                    |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1663 |                                                                                                                                     |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1664 | <b>Nonparametric Distribution Free UCLs</b>                                                                                         |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1665 | 95% CLT UCL                                                                                                                         | 1.678  | 95% Jackknife UCL                                               |   |                                         |   | 1.733  |   |   |   |   |
| 1666 | 95% Standard Bootstrap UCL                                                                                                          | 1.652  | 95% Bootstrap-t UCL                                             |   |                                         |   | 1.883  |   |   |   |   |
| 1667 | 95% Hall's Bootstrap UCL                                                                                                            | 1.647  | 95% Percentile Bootstrap UCL                                    |   |                                         |   | 1.652  |   |   |   |   |
| 1668 | 95% BCA Bootstrap UCL                                                                                                               | 1.694  |                                                                 |   |                                         |   |        |   |   |   |   |
| 1669 | 90% Chebyshev(Mean, Sd) UCL                                                                                                         | 2.022  | 95% Chebyshev(Mean, Sd) UCL                                     |   |                                         |   | 2.366  |   |   |   |   |
| 1670 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                       | 2.845  | 99% Chebyshev(Mean, Sd) UCL                                     |   |                                         |   | 3.784  |   |   |   |   |
| 1671 |                                                                                                                                     |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1672 | <b>Suggested UCL to Use</b>                                                                                                         |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1673 | 95% Student's-t UCL                                                                                                                 | 1.733  |                                                                 |   |                                         |   |        |   |   |   |   |
| 1674 |                                                                                                                                     |        |                                                                 |   |                                         |   |        |   |   |   |   |
| 1675 | <b>Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.</b> |        |                                                                 |   |                                         |   |        |   |   |   |   |

| A    | B                                                                                                                                        | C      | D                                                               | E | F                                       | G | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------------------|---|-----------------------------------------|---|---|---|---|---|---|
| 1676 | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1677 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1678 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1679 |                                                                                                                                          |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1680 |                                                                                                                                          |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1681 | <b>Result (eu3_arsenic_roadway)</b>                                                                                                      |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1682 |                                                                                                                                          |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1683 | <b>General Statistics</b>                                                                                                                |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1684 | Total Number of Observations                                                                                                             | 9      | Number of Distinct Observations                                 |   | 9                                       |   |   |   |   |   |   |
| 1685 |                                                                                                                                          |        | Number of Missing Observations                                  |   | 0                                       |   |   |   |   |   |   |
| 1686 | Minimum                                                                                                                                  | 7.2    | Mean                                                            |   | 16.33                                   |   |   |   |   |   |   |
| 1687 | Maximum                                                                                                                                  | 21     | Median                                                          |   | 18.7                                    |   |   |   |   |   |   |
| 1688 | SD                                                                                                                                       | 4.623  | Std. Error of Mean                                              |   | 1.541                                   |   |   |   |   |   |   |
| 1689 | Coefficient of Variation                                                                                                                 | 0.283  | Skewness                                                        |   | -1.064                                  |   |   |   |   |   |   |
| 1690 |                                                                                                                                          |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1691 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1692 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1693 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1694 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1695 |                                                                                                                                          |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1696 | <b>Normal GOF Test</b>                                                                                                                   |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1697 | Shapiro Wilk Test Statistic                                                                                                              | 0.867  | <b>Shapiro Wilk GOF Test</b>                                    |   |                                         |   |   |   |   |   |   |
| 1698 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.829  | Data appear Normal at 5% Significance Level                     |   |                                         |   |   |   |   |   |   |
| 1699 | Lilliefors Test Statistic                                                                                                                | 0.251  | <b>Lilliefors GOF Test</b>                                      |   |                                         |   |   |   |   |   |   |
| 1700 | 5% Lilliefors Critical Value                                                                                                             | 0.274  | Data appear Normal at 5% Significance Level                     |   |                                         |   |   |   |   |   |   |
| 1701 | <b>Data appear Normal at 5% Significance Level</b>                                                                                       |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1702 |                                                                                                                                          |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1703 | <b>Assuming Normal Distribution</b>                                                                                                      |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1704 | <b>95% Normal UCL</b>                                                                                                                    |        |                                                                 |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |   |   |   |   |   |
| 1705 | 95% Student's-t UCL                                                                                                                      | 19.2   | 95% Adjusted-CLT UCL (Chen-1995)                                |   | 18.28                                   |   |   |   |   |   |   |
| 1706 |                                                                                                                                          |        | 95% Modified-t UCL (Johnson-1978)                               |   | 19.11                                   |   |   |   |   |   |   |
| 1707 |                                                                                                                                          |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1708 | <b>Gamma GOF Test</b>                                                                                                                    |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1709 | A-D Test Statistic                                                                                                                       | 0.716  | <b>Anderson-Darling Gamma GOF Test</b>                          |   |                                         |   |   |   |   |   |   |
| 1710 | 5% A-D Critical Value                                                                                                                    | 0.722  | Detected data appear Gamma Distributed at 5% Significance Level |   |                                         |   |   |   |   |   |   |
| 1711 | K-S Test Statistic                                                                                                                       | 0.267  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |                                         |   |   |   |   |   |   |
| 1712 | 5% K-S Critical Value                                                                                                                    | 0.279  | Detected data appear Gamma Distributed at 5% Significance Level |   |                                         |   |   |   |   |   |   |
| 1713 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1714 |                                                                                                                                          |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1715 | <b>Gamma Statistics</b>                                                                                                                  |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1716 | k hat (MLE)                                                                                                                              | 10.87  | k star (bias corrected MLE)                                     |   | 7.323                                   |   |   |   |   |   |   |
| 1717 | Theta hat (MLE)                                                                                                                          | 1.502  | Theta star (bias corrected MLE)                                 |   | 2.23                                    |   |   |   |   |   |   |
| 1718 | nu hat (MLE)                                                                                                                             | 195.7  | nu star (bias corrected)                                        |   | 131.8                                   |   |   |   |   |   |   |
| 1719 | MLE Mean (bias corrected)                                                                                                                | 16.33  | MLE Sd (bias corrected)                                         |   | 6.036                                   |   |   |   |   |   |   |
| 1720 |                                                                                                                                          |        | Approximate Chi Square Value (0.05)                             |   | 106.3                                   |   |   |   |   |   |   |
| 1721 | Adjusted Level of Significance                                                                                                           | 0.0231 | Adjusted Chi Square Value                                       |   | 101.5                                   |   |   |   |   |   |   |
| 1722 |                                                                                                                                          |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1723 | <b>Assuming Gamma Distribution</b>                                                                                                       |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1724 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | 20.26  | 95% Adjusted Gamma UCL (use when n<50)                          |   | 21.22                                   |   |   |   |   |   |   |
| 1725 |                                                                                                                                          |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1726 | <b>Lognormal GOF Test</b>                                                                                                                |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1727 | Shapiro Wilk Test Statistic                                                                                                              | 0.806  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |                                         |   |   |   |   |   |   |
| 1728 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.829  | Data Not Lognormal at 5% Significance Level                     |   |                                         |   |   |   |   |   |   |
| 1729 | Lilliefors Test Statistic                                                                                                                | 0.255  | <b>Lilliefors Lognormal GOF Test</b>                            |   |                                         |   |   |   |   |   |   |
| 1730 | 5% Lilliefors Critical Value                                                                                                             | 0.274  | Data appear Lognormal at 5% Significance Level                  |   |                                         |   |   |   |   |   |   |
| 1731 | <b>Data appear Approximate Lognormal at 5% Significance Level</b>                                                                        |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1732 |                                                                                                                                          |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1733 | <b>Lognormal Statistics</b>                                                                                                              |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1734 | Minimum of Logged Data                                                                                                                   | 1.974  | Mean of logged Data                                             |   | 2.747                                   |   |   |   |   |   |   |
| 1735 | Maximum of Logged Data                                                                                                                   | 3.045  | SD of logged Data                                               |   | 0.348                                   |   |   |   |   |   |   |
| 1736 |                                                                                                                                          |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1737 | <b>Assuming Lognormal Distribution</b>                                                                                                   |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1738 | 95% H-UCL                                                                                                                                | 21.37  | 90% Chebyshev (MVUE) UCL                                        |   | 22.22                                   |   |   |   |   |   |   |
| 1739 | 95% Chebyshev (MVUE) UCL                                                                                                                 | 24.83  | 97.5% Chebyshev (MVUE) UCL                                      |   | 28.46                                   |   |   |   |   |   |   |
| 1740 | 99% Chebyshev (MVUE) UCL                                                                                                                 | 35.59  |                                                                 |   |                                         |   |   |   |   |   |   |
| 1741 |                                                                                                                                          |        |                                                                 |   |                                         |   |   |   |   |   |   |
| 1742 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |                                                                 |   |                                         |   |   |   |   |   |   |

| A    | B                                                                                                                                                                                                                    | C      | D                                                               | E     | F | G | H | I | J | K | L |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------------------|-------|---|---|---|---|---|---|---|
| 1743 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                                                                                                     |        |                                                                 |       |   |   |   |   |   |   |   |
| 1744 |                                                                                                                                                                                                                      |        |                                                                 |       |   |   |   |   |   |   |   |
| 1745 | <b>Nonparametric Distribution Free UCLs</b>                                                                                                                                                                          |        |                                                                 |       |   |   |   |   |   |   |   |
| 1746 | 95% CLT UCL                                                                                                                                                                                                          | 18.87  | 95% Jackknife UCL                                               | 19.2  |   |   |   |   |   |   |   |
| 1747 | 95% Standard Bootstrap UCL                                                                                                                                                                                           | 18.76  | 95% Bootstrap-t UCL                                             | 18.59 |   |   |   |   |   |   |   |
| 1748 | 95% Hall's Bootstrap UCL                                                                                                                                                                                             | 18.33  | 95% Percentile Bootstrap UCL                                    | 18.59 |   |   |   |   |   |   |   |
| 1749 | 95% BCA Bootstrap UCL                                                                                                                                                                                                | 18.36  |                                                                 |       |   |   |   |   |   |   |   |
| 1750 | 90% Chebyshev(Mean, Sd) UCL                                                                                                                                                                                          | 20.96  | 95% Chebyshev(Mean, Sd) UCL                                     | 23.05 |   |   |   |   |   |   |   |
| 1751 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                                                                                                        | 25.96  | 99% Chebyshev(Mean, Sd) UCL                                     | 31.67 |   |   |   |   |   |   |   |
| 1752 |                                                                                                                                                                                                                      |        |                                                                 |       |   |   |   |   |   |   |   |
| 1753 | <b>Suggested UCL to Use</b>                                                                                                                                                                                          |        |                                                                 |       |   |   |   |   |   |   |   |
| 1754 | 95% Student's-t UCL                                                                                                                                                                                                  | 19.2   |                                                                 |       |   |   |   |   |   |   |   |
| 1755 |                                                                                                                                                                                                                      |        |                                                                 |       |   |   |   |   |   |   |   |
| 1756 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.                                                                                         |        |                                                                 |       |   |   |   |   |   |   |   |
| 1757 | Recommendations are based upon data size, data distribution, and skewness.                                                                                                                                           |        |                                                                 |       |   |   |   |   |   |   |   |
| 1758 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                                                                                             |        |                                                                 |       |   |   |   |   |   |   |   |
| 1759 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician                                                                             |        |                                                                 |       |   |   |   |   |   |   |   |
| 1760 |                                                                                                                                                                                                                      |        |                                                                 |       |   |   |   |   |   |   |   |
| 1761 | <b>Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.</b> |        |                                                                 |       |   |   |   |   |   |   |   |
| 1762 |                                                                                                                                                                                                                      |        |                                                                 |       |   |   |   |   |   |   |   |
| 1763 |                                                                                                                                                                                                                      |        |                                                                 |       |   |   |   |   |   |   |   |
| 1764 |                                                                                                                                                                                                                      |        |                                                                 |       |   |   |   |   |   |   |   |
| 1765 | <b>Result (eu3_cadmium_roadway)</b>                                                                                                                                                                                  |        |                                                                 |       |   |   |   |   |   |   |   |
| 1766 |                                                                                                                                                                                                                      |        |                                                                 |       |   |   |   |   |   |   |   |
| 1767 | <b>General Statistics</b>                                                                                                                                                                                            |        |                                                                 |       |   |   |   |   |   |   |   |
| 1768 | Total Number of Observations                                                                                                                                                                                         | 9      | Number of Distinct Observations                                 | 9     |   |   |   |   |   |   |   |
| 1769 |                                                                                                                                                                                                                      |        | Number of Missing Observations                                  | 0     |   |   |   |   |   |   |   |
| 1770 | Minimum                                                                                                                                                                                                              | 0.36   | Mean                                                            | 1.188 |   |   |   |   |   |   |   |
| 1771 | Maximum                                                                                                                                                                                                              | 2.1    | Median                                                          | 0.91  |   |   |   |   |   |   |   |
| 1772 | SD                                                                                                                                                                                                                   | 0.638  | Std. Error of Mean                                              | 0.213 |   |   |   |   |   |   |   |
| 1773 | Coefficient of Variation                                                                                                                                                                                             | 0.537  | Skewness                                                        | 0.402 |   |   |   |   |   |   |   |
| 1774 |                                                                                                                                                                                                                      |        |                                                                 |       |   |   |   |   |   |   |   |
| 1775 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>           |        |                                                                 |       |   |   |   |   |   |   |   |
| 1776 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                                                                                                  |        |                                                                 |       |   |   |   |   |   |   |   |
| 1777 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                                                                                                       |        |                                                                 |       |   |   |   |   |   |   |   |
| 1778 |                                                                                                                                                                                                                      |        |                                                                 |       |   |   |   |   |   |   |   |
| 1779 |                                                                                                                                                                                                                      |        |                                                                 |       |   |   |   |   |   |   |   |
| 1780 | <b>Normal GOF Test</b>                                                                                                                                                                                               |        |                                                                 |       |   |   |   |   |   |   |   |
| 1781 | Shapiro Wilk Test Statistic                                                                                                                                                                                          | 0.902  | <b>Shapiro Wilk GOF Test</b>                                    |       |   |   |   |   |   |   |   |
| 1782 | 5% Shapiro Wilk Critical Value                                                                                                                                                                                       | 0.829  | Data appear Normal at 5% Significance Level                     |       |   |   |   |   |   |   |   |
| 1783 | Lilliefors Test Statistic                                                                                                                                                                                            | 0.224  | <b>Lilliefors GOF Test</b>                                      |       |   |   |   |   |   |   |   |
| 1784 | 5% Lilliefors Critical Value                                                                                                                                                                                         | 0.274  | Data appear Normal at 5% Significance Level                     |       |   |   |   |   |   |   |   |
| 1785 | <b>Data appear Normal at 5% Significance Level</b>                                                                                                                                                                   |        |                                                                 |       |   |   |   |   |   |   |   |
| 1786 |                                                                                                                                                                                                                      |        |                                                                 |       |   |   |   |   |   |   |   |
| 1787 | <b>Assuming Normal Distribution</b>                                                                                                                                                                                  |        |                                                                 |       |   |   |   |   |   |   |   |
| 1788 | <b>95% Normal UCL</b>                                                                                                                                                                                                |        | <b>95% UCLs (Adjusted for Skewness)</b>                         |       |   |   |   |   |   |   |   |
| 1789 | 95% Student's-t UCL                                                                                                                                                                                                  | 1.583  | 95% Adjusted-CLT UCL (Chen-1995)                                | 1.568 |   |   |   |   |   |   |   |
| 1790 |                                                                                                                                                                                                                      |        | 95% Modified-t UCL (Johnson-1978)                               | 1.588 |   |   |   |   |   |   |   |
| 1791 |                                                                                                                                                                                                                      |        |                                                                 |       |   |   |   |   |   |   |   |
| 1792 | <b>Gamma GOF Test</b>                                                                                                                                                                                                |        |                                                                 |       |   |   |   |   |   |   |   |
| 1793 | A-D Test Statistic                                                                                                                                                                                                   | 0.335  | <b>Anderson-Darling Gamma GOF Test</b>                          |       |   |   |   |   |   |   |   |
| 1794 | 5% A-D Critical Value                                                                                                                                                                                                | 0.726  | Detected data appear Gamma Distributed at 5% Significance Level |       |   |   |   |   |   |   |   |
| 1795 | K-S Test Statistic                                                                                                                                                                                                   | 0.18   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |       |   |   |   |   |   |   |   |
| 1796 | 5% K-S Critical Value                                                                                                                                                                                                | 0.281  | Detected data appear Gamma Distributed at 5% Significance Level |       |   |   |   |   |   |   |   |
| 1797 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                                                                                               |        |                                                                 |       |   |   |   |   |   |   |   |
| 1798 |                                                                                                                                                                                                                      |        |                                                                 |       |   |   |   |   |   |   |   |
| 1799 | <b>Gamma Statistics</b>                                                                                                                                                                                              |        |                                                                 |       |   |   |   |   |   |   |   |
| 1800 | k hat (MLE)                                                                                                                                                                                                          | 3.634  | k star (bias corrected MLE)                                     | 2.497 |   |   |   |   |   |   |   |
| 1801 | Theta hat (MLE)                                                                                                                                                                                                      | 0.327  | Theta star (bias corrected MLE)                                 | 0.476 |   |   |   |   |   |   |   |
| 1802 | nu hat (MLE)                                                                                                                                                                                                         | 65.41  | nu star (bias corrected)                                        | 44.94 |   |   |   |   |   |   |   |
| 1803 | MLE Mean (bias corrected)                                                                                                                                                                                            | 1.188  | MLE Sd (bias corrected)                                         | 0.752 |   |   |   |   |   |   |   |
| 1804 |                                                                                                                                                                                                                      |        | Approximate Chi Square Value (0.05)                             | 30.56 |   |   |   |   |   |   |   |
| 1805 | Adjusted Level of Significance                                                                                                                                                                                       | 0.0231 | Adjusted Chi Square Value                                       | 28.08 |   |   |   |   |   |   |   |
| 1806 |                                                                                                                                                                                                                      |        |                                                                 |       |   |   |   |   |   |   |   |
| 1807 | <b>Assuming Gamma Distribution</b>                                                                                                                                                                                   |        |                                                                 |       |   |   |   |   |   |   |   |
| 1808 | 95% Approximate Gamma UCL (use when n>=50)                                                                                                                                                                           | 1.747  | 95% Adjusted Gamma UCL (use when n<50)                          | 1.901 |   |   |   |   |   |   |   |
| 1809 |                                                                                                                                                                                                                      |        |                                                                 |       |   |   |   |   |   |   |   |

|      | A                                                                                                                                         | B | C      | D | E                                                               | F | G | H | I      | J | K | L |
|------|-------------------------------------------------------------------------------------------------------------------------------------------|---|--------|---|-----------------------------------------------------------------|---|---|---|--------|---|---|---|
| 1810 | <b>Lognormal GOF Test</b>                                                                                                                 |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1811 | Shapiro Wilk Test Statistic                                                                                                               |   | 0.936  |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |   |        |   |   |   |
| 1812 | 5% Shapiro Wilk Critical Value                                                                                                            |   | 0.829  |   | Data appear Lognormal at 5% Significance Level                  |   |   |   |        |   |   |   |
| 1813 | Lilliefors Test Statistic                                                                                                                 |   | 0.161  |   | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |   |        |   |   |   |
| 1814 | 5% Lilliefors Critical Value                                                                                                              |   | 0.274  |   | Data appear Lognormal at 5% Significance Level                  |   |   |   |        |   |   |   |
| 1815 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                     |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1816 |                                                                                                                                           |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1817 | <b>Lognormal Statistics</b>                                                                                                               |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1818 | Minimum of Logged Data                                                                                                                    |   | -1.022 |   | Mean of logged Data                                             |   |   |   | 0.0282 |   |   |   |
| 1819 | Maximum of Logged Data                                                                                                                    |   | 0.742  |   | SD of logged Data                                               |   |   |   | 0.591  |   |   |   |
| 1820 |                                                                                                                                           |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1821 | <b>Assuming Lognormal Distribution</b>                                                                                                    |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1822 | 95% H-UCL                                                                                                                                 |   | 2.029  |   | 90% Chebyshev (MVUE) UCL                                        |   |   |   | 1.92   |   |   |   |
| 1823 | 95% Chebyshev (MVUE) UCL                                                                                                                  |   | 2.247  |   | 97.5% Chebyshev (MVUE) UCL                                      |   |   |   | 2.701  |   |   |   |
| 1824 | 99% Chebyshev (MVUE) UCL                                                                                                                  |   | 3.592  |   |                                                                 |   |   |   |        |   |   |   |
| 1825 |                                                                                                                                           |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1826 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                     |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1827 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                          |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1828 |                                                                                                                                           |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1829 | <b>Nonparametric Distribution Free UCLs</b>                                                                                               |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1830 | 95% CLT UCL                                                                                                                               |   | 1.538  |   | 95% Jackknife UCL                                               |   |   |   | 1.583  |   |   |   |
| 1831 | 95% Standard Bootstrap UCL                                                                                                                |   | 1.52   |   | 95% Bootstrap-t UCL                                             |   |   |   | 1.627  |   |   |   |
| 1832 | 95% Hall's Bootstrap UCL                                                                                                                  |   | 1.48   |   | 95% Percentile Bootstrap UCL                                    |   |   |   | 1.508  |   |   |   |
| 1833 | 95% BCA Bootstrap UCL                                                                                                                     |   | 1.562  |   |                                                                 |   |   |   |        |   |   |   |
| 1834 | 90% Chebyshev(Mean, Sd) UCL                                                                                                               |   | 1.826  |   | 95% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 2.115  |   |   |   |
| 1835 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                             |   | 2.516  |   | 99% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 3.304  |   |   |   |
| 1836 |                                                                                                                                           |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1837 | <b>Suggested UCL to Use</b>                                                                                                               |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1838 | 95% Student's-t UCL                                                                                                                       |   | 1.583  |   |                                                                 |   |   |   |        |   |   |   |
| 1839 |                                                                                                                                           |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1840 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1841 | Recommendations are based upon data size, data distribution, and skewness.                                                                |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1842 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1843 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1844 |                                                                                                                                           |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1845 |                                                                                                                                           |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1846 | <b>Result (eu3_chromium_roadway)</b>                                                                                                      |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1847 |                                                                                                                                           |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1848 | <b>General Statistics</b>                                                                                                                 |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1849 | Total Number of Observations                                                                                                              |   | 9      |   | Number of Distinct Observations                                 |   |   |   | 8      |   |   |   |
| 1850 |                                                                                                                                           |   |        |   | Number of Missing Observations                                  |   |   |   | 0      |   |   |   |
| 1851 | Minimum                                                                                                                                   |   | 4.1    |   | Mean                                                            |   |   |   | 6.133  |   |   |   |
| 1852 | Maximum                                                                                                                                   |   | 8.4    |   | Median                                                          |   |   |   | 6.4    |   |   |   |
| 1853 | SD                                                                                                                                        |   | 1.248  |   | Std. Error of Mean                                              |   |   |   | 0.416  |   |   |   |
| 1854 | Coefficient of Variation                                                                                                                  |   | 0.203  |   | Skewness                                                        |   |   |   | 0.222  |   |   |   |
| 1855 |                                                                                                                                           |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1856 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                                |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1857 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                    |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1858 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                       |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1859 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                            |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1860 |                                                                                                                                           |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1861 | <b>Normal GOF Test</b>                                                                                                                    |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1862 | Shapiro Wilk Test Statistic                                                                                                               |   | 0.976  |   | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |        |   |   |   |
| 1863 | 5% Shapiro Wilk Critical Value                                                                                                            |   | 0.829  |   | Data appear Normal at 5% Significance Level                     |   |   |   |        |   |   |   |
| 1864 | Lilliefors Test Statistic                                                                                                                 |   | 0.14   |   | <b>Lilliefors GOF Test</b>                                      |   |   |   |        |   |   |   |
| 1865 | 5% Lilliefors Critical Value                                                                                                              |   | 0.274  |   | Data appear Normal at 5% Significance Level                     |   |   |   |        |   |   |   |
| 1866 | <b>Data appear Normal at 5% Significance Level</b>                                                                                        |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1867 |                                                                                                                                           |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1868 | <b>Assuming Normal Distribution</b>                                                                                                       |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1869 | <b>95% Normal UCL</b>                                                                                                                     |   |        |   | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |   |        |   |   |   |
| 1870 | 95% Student's-t UCL                                                                                                                       |   | 6.907  |   | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |   | 6.85   |   |   |   |
| 1871 |                                                                                                                                           |   |        |   | 95% Modified-t UCL (Johnson-1978)                               |   |   |   | 6.912  |   |   |   |
| 1872 |                                                                                                                                           |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1873 | <b>Gamma GOF Test</b>                                                                                                                     |   |        |   |                                                                 |   |   |   |        |   |   |   |
| 1874 | A-D Test Statistic                                                                                                                        |   | 0.212  |   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |   |        |   |   |   |
| 1875 | 5% A-D Critical Value                                                                                                                     |   | 0.721  |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |        |   |   |   |
| 1876 | K-S Test Statistic                                                                                                                        |   | 0.168  |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |   |        |   |   |   |

| A    | B                                                                                                                                        | C                              | D                                      | E                                              | F                                                               | G     | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------|------------------------------------------------|-----------------------------------------------------------------|-------|---|---|---|---|---|
| 1877 |                                                                                                                                          |                                | 5% K-S Critical Value                  | 0.279                                          | Detected data appear Gamma Distributed at 5% Significance Level |       |   |   |   |   |   |
| 1878 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1879 |                                                                                                                                          |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1880 | <b>Gamma Statistics</b>                                                                                                                  |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1881 |                                                                                                                                          | k hat (MLE)                    | 26.66                                  |                                                | k star (bias corrected MLE)                                     | 17.85 |   |   |   |   |   |
| 1882 |                                                                                                                                          | Theta hat (MLE)                | 0.23                                   |                                                | Theta star (bias corrected MLE)                                 | 0.344 |   |   |   |   |   |
| 1883 |                                                                                                                                          | nu hat (MLE)                   | 479.8                                  |                                                | nu star (bias corrected)                                        | 321.2 |   |   |   |   |   |
| 1884 |                                                                                                                                          | MLE Mean (bias corrected)      | 6.133                                  |                                                | MLE Sd (bias corrected)                                         | 1.452 |   |   |   |   |   |
| 1885 |                                                                                                                                          |                                |                                        |                                                | Approximate Chi Square Value (0.05)                             | 280.7 |   |   |   |   |   |
| 1886 |                                                                                                                                          | Adjusted Level of Significance | 0.0231                                 |                                                | Adjusted Chi Square Value                                       | 272.7 |   |   |   |   |   |
| 1887 |                                                                                                                                          |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1888 | <b>Assuming Gamma Distribution</b>                                                                                                       |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1889 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | 7.019                          | 95% Adjusted Gamma UCL (use when n<50) | 7.225                                          |                                                                 |       |   |   |   |   |   |
| 1890 |                                                                                                                                          |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1891 | <b>Lognormal GOF Test</b>                                                                                                                |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1892 |                                                                                                                                          | Shapiro Wilk Test Statistic    | 0.973                                  | <b>Shapiro Wilk Lognormal GOF Test</b>         |                                                                 |       |   |   |   |   |   |
| 1893 |                                                                                                                                          | 5% Shapiro Wilk Critical Value | 0.829                                  | Data appear Lognormal at 5% Significance Level |                                                                 |       |   |   |   |   |   |
| 1894 |                                                                                                                                          | Lilliefors Test Statistic      | 0.172                                  | <b>Lilliefors Lognormal GOF Test</b>           |                                                                 |       |   |   |   |   |   |
| 1895 |                                                                                                                                          | 5% Lilliefors Critical Value   | 0.274                                  | Data appear Lognormal at 5% Significance Level |                                                                 |       |   |   |   |   |   |
| 1896 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1897 |                                                                                                                                          |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1898 | <b>Lognormal Statistics</b>                                                                                                              |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1899 |                                                                                                                                          | Minimum of Logged Data         | 1.411                                  |                                                | Mean of logged Data                                             | 1.795 |   |   |   |   |   |
| 1900 |                                                                                                                                          | Maximum of Logged Data         | 2.128                                  |                                                | SD of logged Data                                               | 0.208 |   |   |   |   |   |
| 1901 |                                                                                                                                          |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1902 | <b>Assuming Lognormal Distribution</b>                                                                                                   |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1903 |                                                                                                                                          | 95% H-UCL                      | 7.081                                  |                                                | 90% Chebyshev (MVUE) UCL                                        | 7.416 |   |   |   |   |   |
| 1904 |                                                                                                                                          | 95% Chebyshev (MVUE) UCL       | 7.996                                  |                                                | 97.5% Chebyshev (MVUE) UCL                                      | 8.801 |   |   |   |   |   |
| 1905 |                                                                                                                                          | 99% Chebyshev (MVUE) UCL       | 10.38                                  |                                                |                                                                 |       |   |   |   |   |   |
| 1906 |                                                                                                                                          |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1907 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1908 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1909 |                                                                                                                                          |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1910 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1911 |                                                                                                                                          | 95% CLT UCL                    | 6.818                                  |                                                | 95% Jackknife UCL                                               | 6.907 |   |   |   |   |   |
| 1912 |                                                                                                                                          | 95% Standard Bootstrap UCL     | 6.764                                  |                                                | 95% Bootstrap-t UCL                                             | 6.945 |   |   |   |   |   |
| 1913 |                                                                                                                                          | 95% Hall's Bootstrap UCL       | 6.958                                  |                                                | 95% Percentile Bootstrap UCL                                    | 6.756 |   |   |   |   |   |
| 1914 |                                                                                                                                          | 95% BCA Bootstrap UCL          | 6.778                                  |                                                |                                                                 |       |   |   |   |   |   |
| 1915 |                                                                                                                                          | 90% Chebyshev(Mean, Sd) UCL    | 7.381                                  |                                                | 95% Chebyshev(Mean, Sd) UCL                                     | 7.947 |   |   |   |   |   |
| 1916 |                                                                                                                                          | 97.5% Chebyshev(Mean, Sd) UCL  | 8.731                                  |                                                | 99% Chebyshev(Mean, Sd) UCL                                     | 10.27 |   |   |   |   |   |
| 1917 |                                                                                                                                          |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1918 | <b>Suggested UCL to Use</b>                                                                                                              |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1919 |                                                                                                                                          | 95% Student's-t UCL            | 6.907                                  |                                                |                                                                 |       |   |   |   |   |   |
| 1920 |                                                                                                                                          |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1921 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1922 | Recommendations are based upon data size, data distribution, and skewness.                                                               |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1923 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1924 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1925 |                                                                                                                                          |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1926 |                                                                                                                                          |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1927 | <b>Result (eu3_cobalt_roadway)</b>                                                                                                       |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1928 |                                                                                                                                          |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1929 | <b>General Statistics</b>                                                                                                                |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1930 |                                                                                                                                          | Total Number of Observations   | 9                                      |                                                | Number of Distinct Observations                                 | 9     |   |   |   |   |   |
| 1931 |                                                                                                                                          |                                |                                        |                                                | Number of Missing Observations                                  | 0     |   |   |   |   |   |
| 1932 |                                                                                                                                          | Minimum                        | 4.5                                    |                                                | Mean                                                            | 6.789 |   |   |   |   |   |
| 1933 |                                                                                                                                          | Maximum                        | 11.7                                   |                                                | Median                                                          | 6.4   |   |   |   |   |   |
| 1934 |                                                                                                                                          | SD                             | 2.101                                  |                                                | Std. Error of Mean                                              | 0.7   |   |   |   |   |   |
| 1935 |                                                                                                                                          | Coefficient of Variation       | 0.31                                   |                                                | Skewness                                                        | 1.719 |   |   |   |   |   |
| 1936 |                                                                                                                                          |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1937 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1938 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1939 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1940 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1941 |                                                                                                                                          |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1942 | <b>Normal GOF Test</b>                                                                                                                   |                                |                                        |                                                |                                                                 |       |   |   |   |   |   |
| 1943 |                                                                                                                                          | Shapiro Wilk Test Statistic    | 0.844                                  | <b>Shapiro Wilk GOF Test</b>                   |                                                                 |       |   |   |   |   |   |

| A    | B                                                                                                                                       | C | D | E      | F                                                             | G | H | I | J     | K | L |  |
|------|-----------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|---------------------------------------------------------------|---|---|---|-------|---|---|--|
| 1944 | 5% Shapiro Wilk Critical Value                                                                                                          |   |   | 0.829  | Data appear Normal at 5% Significance Level                   |   |   |   |       |   |   |  |
| 1945 | Lilliefors Test Statistic                                                                                                               |   |   | 0.221  | <b>Lilliefors GOF Test</b>                                    |   |   |   |       |   |   |  |
| 1946 | 5% Lilliefors Critical Value                                                                                                            |   |   | 0.274  | Data appear Normal at 5% Significance Level                   |   |   |   |       |   |   |  |
| 1947 | <b>Data appear Normal at 5% Significance Level</b>                                                                                      |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1948 |                                                                                                                                         |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1949 | <b>Assuming Normal Distribution</b>                                                                                                     |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1950 | <b>95% Normal UCL</b>                                                                                                                   |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>                       |   |   |   |       |   |   |  |
| 1951 | 95% Student's-t UCL                                                                                                                     |   |   | 8.091  | 95% Adjusted-CLT UCL (Chen-1995)                              |   |   |   | 8.37  |   |   |  |
| 1952 |                                                                                                                                         |   |   |        | 95% Modified-t UCL (Johnson-1978)                             |   |   |   | 8.158 |   |   |  |
| 1953 |                                                                                                                                         |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1954 | <b>Gamma GOF Test</b>                                                                                                                   |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1955 | A-D Test Statistic                                                                                                                      |   |   | 0.382  | <b>Anderson-Darling Gamma GOF Test</b>                        |   |   |   |       |   |   |  |
| 1956 | 5% A-D Critical Value                                                                                                                   |   |   | 0.721  | Detected data appear Gamma Distributed at 5% Significance Lev |   |   |   |       |   |   |  |
| 1957 | K-S Test Statistic                                                                                                                      |   |   | 0.176  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                      |   |   |   |       |   |   |  |
| 1958 | 5% K-S Critical Value                                                                                                                   |   |   | 0.279  | Detected data appear Gamma Distributed at 5% Significance Lev |   |   |   |       |   |   |  |
| 1959 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                  |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1960 |                                                                                                                                         |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1961 | <b>Gamma Statistics</b>                                                                                                                 |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1962 | k hat (MLE)                                                                                                                             |   |   | 13.89  | k star (bias corrected MLE)                                   |   |   |   | 9.337 |   |   |  |
| 1963 | Theta hat (MLE)                                                                                                                         |   |   | 0.489  | Theta star (bias corrected MLE)                               |   |   |   | 0.727 |   |   |  |
| 1964 | nu hat (MLE)                                                                                                                            |   |   | 250.1  | nu star (bias corrected)                                      |   |   |   | 168.1 |   |   |  |
| 1965 | MLE Mean (bias corrected)                                                                                                               |   |   | 6.789  | MLE Sd (bias corrected)                                       |   |   |   | 2.222 |   |   |  |
| 1966 |                                                                                                                                         |   |   |        | Approximate Chi Square Value (0.05)                           |   |   |   | 139.1 |   |   |  |
| 1967 | Adjusted Level of Significance                                                                                                          |   |   | 0.0231 | Adjusted Chi Square Value                                     |   |   |   | 133.5 |   |   |  |
| 1968 |                                                                                                                                         |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1969 | <b>Assuming Gamma Distribution</b>                                                                                                      |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1970 | 95% Approximate Gamma UCL (use when n>=50))                                                                                             |   |   | 8.203  | 95% Adjusted Gamma UCL (use when n<50)                        |   |   |   | 8.545 |   |   |  |
| 1971 |                                                                                                                                         |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1972 | <b>Lognormal GOF Test</b>                                                                                                               |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1973 | Shapiro Wilk Test Statistic                                                                                                             |   |   | 0.935  | <b>Shapiro Wilk Lognormal GOF Test</b>                        |   |   |   |       |   |   |  |
| 1974 | 5% Shapiro Wilk Critical Value                                                                                                          |   |   | 0.829  | Data appear Lognormal at 5% Significance Level                |   |   |   |       |   |   |  |
| 1975 | Lilliefors Test Statistic                                                                                                               |   |   | 0.168  | <b>Lilliefors Lognormal GOF Test</b>                          |   |   |   |       |   |   |  |
| 1976 | 5% Lilliefors Critical Value                                                                                                            |   |   | 0.274  | Data appear Lognormal at 5% Significance Level                |   |   |   |       |   |   |  |
| 1977 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                   |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1978 |                                                                                                                                         |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1979 | <b>Lognormal Statistics</b>                                                                                                             |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1980 | Minimum of Logged Data                                                                                                                  |   |   | 1.504  | Mean of logged Data                                           |   |   |   | 1.879 |   |   |  |
| 1981 | Maximum of Logged Data                                                                                                                  |   |   | 2.46   | SD of logged Data                                             |   |   |   | 0.277 |   |   |  |
| 1982 |                                                                                                                                         |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1983 | <b>Assuming Lognormal Distribution</b>                                                                                                  |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1984 | 95% H-UCL                                                                                                                               |   |   | 8.263  | 90% Chebyshev (MVUE) UCL                                      |   |   |   | 8.658 |   |   |  |
| 1985 | 95% Chebyshev (MVUE) UCL                                                                                                                |   |   | 9.512  | 97.5% Chebyshev (MVUE) UCL                                    |   |   |   | 10.7  |   |   |  |
| 1986 | 99% Chebyshev (MVUE) UCL                                                                                                                |   |   | 13.03  |                                                               |   |   |   |       |   |   |  |
| 1987 |                                                                                                                                         |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1988 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                   |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1989 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                        |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1990 |                                                                                                                                         |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1991 | <b>Nonparametric Distribution Free UCLs</b>                                                                                             |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1992 | 95% CLT UCL                                                                                                                             |   |   | 7.941  | 95% Jackknife UCL                                             |   |   |   | 8.091 |   |   |  |
| 1993 | 95% Standard Bootstrap UCL                                                                                                              |   |   | 7.88   | 95% Bootstrap-t UCL                                           |   |   |   | 8.846 |   |   |  |
| 1994 | 95% Hall's Bootstrap UCL                                                                                                                |   |   | 13.98  | 95% Percentile Bootstrap UCL                                  |   |   |   | 7.967 |   |   |  |
| 1995 | 95% BCA Bootstrap UCL                                                                                                                   |   |   | 8.278  |                                                               |   |   |   |       |   |   |  |
| 1996 | 90% Chebyshev(Mean, Sd) UCL                                                                                                             |   |   | 8.89   | 95% Chebyshev(Mean, Sd) UCL                                   |   |   |   | 9.842 |   |   |  |
| 1997 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                           |   |   | 11.16  | 99% Chebyshev(Mean, Sd) UCL                                   |   |   |   | 13.76 |   |   |  |
| 1998 |                                                                                                                                         |   |   |        |                                                               |   |   |   |       |   |   |  |
| 1999 | <b>Suggested UCL to Use</b>                                                                                                             |   |   |        |                                                               |   |   |   |       |   |   |  |
| 2000 | 95% Student's-t UCL                                                                                                                     |   |   | 8.091  |                                                               |   |   |   |       |   |   |  |
| 2001 |                                                                                                                                         |   |   |        |                                                               |   |   |   |       |   |   |  |
| 2002 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.            |   |   |        |                                                               |   |   |   |       |   |   |  |
| 2003 | Recommendations are based upon data size, data distribution, and skewness.                                                              |   |   |        |                                                               |   |   |   |       |   |   |  |
| 2004 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                |   |   |        |                                                               |   |   |   |       |   |   |  |
| 2005 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statisticia |   |   |        |                                                               |   |   |   |       |   |   |  |
| 2006 |                                                                                                                                         |   |   |        |                                                               |   |   |   |       |   |   |  |
| 2007 |                                                                                                                                         |   |   |        |                                                               |   |   |   |       |   |   |  |
| 2008 | <b>Result (eu3_iron_roadway)</b>                                                                                                        |   |   |        |                                                               |   |   |   |       |   |   |  |
| 2009 |                                                                                                                                         |   |   |        |                                                               |   |   |   |       |   |   |  |
| 2010 | <b>General Statistics</b>                                                                                                               |   |   |        |                                                               |   |   |   |       |   |   |  |

|      | A                                                                                                          | B | C | D | E | F      | G                                                   | H | I | J | K | L      |
|------|------------------------------------------------------------------------------------------------------------|---|---|---|---|--------|-----------------------------------------------------|---|---|---|---|--------|
| 2011 | Total Number of Observations                                                                               |   |   |   |   | 9      | Number of Distinct Observations                     |   |   |   |   | 9      |
| 2012 |                                                                                                            |   |   |   |   |        | Number of Missing Observations                      |   |   |   |   | 0      |
| 2013 | Minimum                                                                                                    |   |   |   |   | 19900  | Mean                                                |   |   |   |   | 49711  |
| 2014 | Maximum                                                                                                    |   |   |   |   | 175000 | Median                                              |   |   |   |   | 30000  |
| 2015 | SD                                                                                                         |   |   |   |   | 49499  | Std. Error of Mean                                  |   |   |   |   | 16500  |
| 2016 | Coefficient of Variation                                                                                   |   |   |   |   | 0.996  | Skewness                                            |   |   |   |   | 2.519  |
| 2017 |                                                                                                            |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2018 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b> |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2019 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>     |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2020 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                        |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2021 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>             |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2022 |                                                                                                            |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2023 | <b>Normal GOF Test</b>                                                                                     |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2024 | Shapiro Wilk Test Statistic                                                                                |   |   |   |   | 0.611  | <b>Shapiro Wilk GOF Test</b>                        |   |   |   |   |        |
| 2025 | 5% Shapiro Wilk Critical Value                                                                             |   |   |   |   | 0.829  | Data Not Normal at 5% Significance Level            |   |   |   |   |        |
| 2026 | Lilliefors Test Statistic                                                                                  |   |   |   |   | 0.382  | <b>Lilliefors GOF Test</b>                          |   |   |   |   |        |
| 2027 | 5% Lilliefors Critical Value                                                                               |   |   |   |   | 0.274  | Data Not Normal at 5% Significance Level            |   |   |   |   |        |
| 2028 | <b>Data Not Normal at 5% Significance Level</b>                                                            |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2029 |                                                                                                            |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2030 | <b>Assuming Normal Distribution</b>                                                                        |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2031 | <b>95% Normal UCL</b>                                                                                      |   |   |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>             |   |   |   |   |        |
| 2032 | 95% Student's-t UCL                                                                                        |   |   |   |   | 80393  | 95% Adjusted-CLT UCL (Chen-1995)                    |   |   |   |   | 91653  |
| 2033 |                                                                                                            |   |   |   |   |        | 95% Modified-t UCL (Johnson-1978)                   |   |   |   |   | 82702  |
| 2034 |                                                                                                            |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2035 | <b>Gamma GOF Test</b>                                                                                      |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2036 | A-D Test Statistic                                                                                         |   |   |   |   | 1.156  | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |   |   |        |
| 2037 | 5% A-D Critical Value                                                                                      |   |   |   |   | 0.73   | Data Not Gamma Distributed at 5% Significance Level |   |   |   |   |        |
| 2038 | K-S Test Statistic                                                                                         |   |   |   |   | 0.347  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |   |   |        |
| 2039 | 5% K-S Critical Value                                                                                      |   |   |   |   | 0.282  | Data Not Gamma Distributed at 5% Significance Level |   |   |   |   |        |
| 2040 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                 |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2041 |                                                                                                            |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2042 | <b>Gamma Statistics</b>                                                                                    |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2043 | k hat (MLE)                                                                                                |   |   |   |   | 2.041  | k star (bias corrected MLE)                         |   |   |   |   | 1.435  |
| 2044 | Theta hat (MLE)                                                                                            |   |   |   |   | 24355  | Theta star (bias corrected MLE)                     |   |   |   |   | 34646  |
| 2045 | nu hat (MLE)                                                                                               |   |   |   |   | 36.74  | nu star (bias corrected)                            |   |   |   |   | 25.83  |
| 2046 | MLE Mean (bias corrected)                                                                                  |   |   |   |   | 49711  | MLE Sd (bias corrected)                             |   |   |   |   | 41501  |
| 2047 |                                                                                                            |   |   |   |   |        | Approximate Chi Square Value (0.05)                 |   |   |   |   | 15.25  |
| 2048 | Adjusted Level of Significance                                                                             |   |   |   |   | 0.0231 | Adjusted Chi Square Value                           |   |   |   |   | 13.56  |
| 2049 |                                                                                                            |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2050 | <b>Assuming Gamma Distribution</b>                                                                         |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2051 | 95% Approximate Gamma UCL (use when n>=50)                                                                 |   |   |   |   | 84211  | 95% Adjusted Gamma UCL (use when n<50)              |   |   |   |   | 94678  |
| 2052 |                                                                                                            |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2053 | <b>Lognormal GOF Test</b>                                                                                  |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2054 | Shapiro Wilk Test Statistic                                                                                |   |   |   |   | 0.797  | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |   |   |   |        |
| 2055 | 5% Shapiro Wilk Critical Value                                                                             |   |   |   |   | 0.829  | Data Not Lognormal at 5% Significance Level         |   |   |   |   |        |
| 2056 | Lilliefors Test Statistic                                                                                  |   |   |   |   | 0.302  | <b>Lilliefors Lognormal GOF Test</b>                |   |   |   |   |        |
| 2057 | 5% Lilliefors Critical Value                                                                               |   |   |   |   | 0.274  | Data Not Lognormal at 5% Significance Level         |   |   |   |   |        |
| 2058 | <b>Data Not Lognormal at 5% Significance Level</b>                                                         |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2059 |                                                                                                            |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2060 | <b>Lognormal Statistics</b>                                                                                |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2061 | Minimum of Logged Data                                                                                     |   |   |   |   | 9.898  | Mean of logged Data                                 |   |   |   |   | 10.55  |
| 2062 | Maximum of Logged Data                                                                                     |   |   |   |   | 12.07  | SD of logged Data                                   |   |   |   |   | 0.677  |
| 2063 |                                                                                                            |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2064 | <b>Assuming Lognormal Distribution</b>                                                                     |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2065 | 95% H-UCL                                                                                                  |   |   |   |   | 89024  | 90% Chebyshev (MVUE) UCL                            |   |   |   |   | 78889  |
| 2066 | 95% Chebyshev (MVUE) UCL                                                                                   |   |   |   |   | 93514  | 97.5% Chebyshev (MVUE) UCL                          |   |   |   |   | 113815 |
| 2067 | 99% Chebyshev (MVUE) UCL                                                                                   |   |   |   |   | 153690 |                                                     |   |   |   |   |        |
| 2068 |                                                                                                            |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2069 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                      |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2070 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2071 |                                                                                                            |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2072 | <b>Nonparametric Distribution Free UCLs</b>                                                                |   |   |   |   |        |                                                     |   |   |   |   |        |
| 2073 | 95% CLT UCL                                                                                                |   |   |   |   | 76851  | 95% Jackknife UCL                                   |   |   |   |   | 80393  |
| 2074 | 95% Standard Bootstrap UCL                                                                                 |   |   |   |   | 75890  | 95% Bootstrap-t UCL                                 |   |   |   |   | 258128 |
| 2075 | 95% Hall's Bootstrap UCL                                                                                   |   |   |   |   | 245338 | 95% Percentile Bootstrap UCL                        |   |   |   |   | 77178  |
| 2076 | 95% BCA Bootstrap UCL                                                                                      |   |   |   |   | 96422  |                                                     |   |   |   |   |        |
| 2077 | 90% Chebyshev(Mean, Sd) UCL                                                                                |   |   |   |   | 99210  | 95% Chebyshev(Mean, Sd) UCL                         |   |   |   |   | 121632 |

| A    | B                                                                                                                                        | C | D      | E                                                               | F                                       | G                           | H     | I     | J | K      | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|-----------------------------------------------------------------|-----------------------------------------|-----------------------------|-------|-------|---|--------|---|--|
| 2078 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |        |                                                                 | 152752                                  | 99% Chebyshev(Mean, Sd) UCL |       |       |   | 213881 |   |  |
| 2079 |                                                                                                                                          |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2080 | <b>Suggested UCL to Use</b>                                                                                                              |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2081 | 95% Chebyshev (Mean, Sd) UCL                                                                                                             |   |        |                                                                 | 121632                                  |                             |       |       |   |        |   |  |
| 2082 |                                                                                                                                          |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2083 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2084 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2085 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2086 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2087 |                                                                                                                                          |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2088 |                                                                                                                                          |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2089 | <b>Result (eu3_lead_roadway)</b>                                                                                                         |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2090 |                                                                                                                                          |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2091 | <b>General Statistics</b>                                                                                                                |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2092 | Total Number of Observations                                                                                                             |   |        | 9                                                               | Number of Distinct Observations         |                             |       | 9     |   |        |   |  |
| 2093 |                                                                                                                                          |   |        |                                                                 | Number of Missing Observations          |                             |       | 0     |   |        |   |  |
| 2094 | Minimum                                                                                                                                  |   | 53.6   | Mean                                                            |                                         | 241.7                       |       |       |   |        |   |  |
| 2095 | Maximum                                                                                                                                  |   | 393    | Median                                                          |                                         | 279                         |       |       |   |        |   |  |
| 2096 | SD                                                                                                                                       |   | 131.3  | Std. Error of Mean                                              |                                         | 43.76                       |       |       |   |        |   |  |
| 2097 | Coefficient of Variation                                                                                                                 |   | 0.543  | Skewness                                                        |                                         | -0.219                      |       |       |   |        |   |  |
| 2098 |                                                                                                                                          |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2099 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2100 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2101 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2102 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2103 |                                                                                                                                          |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2104 | <b>Normal GOF Test</b>                                                                                                                   |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2105 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.856  | <b>Shapiro Wilk GOF Test</b>                                    |                                         |                             |       |       |   |        |   |  |
| 2106 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.829  | Data appear Normal at 5% Significance Level                     |                                         |                             |       |       |   |        |   |  |
| 2107 | Lilliefors Test Statistic                                                                                                                |   | 0.247  | <b>Lilliefors GOF Test</b>                                      |                                         |                             |       |       |   |        |   |  |
| 2108 | 5% Lilliefors Critical Value                                                                                                             |   | 0.274  | Data appear Normal at 5% Significance Level                     |                                         |                             |       |       |   |        |   |  |
| 2109 | <b>Data appear Normal at 5% Significance Level</b>                                                                                       |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2110 |                                                                                                                                          |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2111 | <b>Assuming Normal Distribution</b>                                                                                                      |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2112 | <b>95% Normal UCL</b>                                                                                                                    |   |        |                                                                 | <b>95% UCLs (Adjusted for Skewness)</b> |                             |       |       |   |        |   |  |
| 2113 | 95% Student's-t UCL                                                                                                                      |   | 323.1  | 95% Adjusted-CLT UCL (Chen-1995)                                |                                         |                             | 310.3 |       |   |        |   |  |
| 2114 |                                                                                                                                          |   |        | 95% Modified-t UCL (Johnson-1978)                               |                                         |                             | 322.6 |       |   |        |   |  |
| 2115 |                                                                                                                                          |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2116 | <b>Gamma GOF Test</b>                                                                                                                    |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2117 | A-D Test Statistic                                                                                                                       |   | 0.693  | <b>Anderson-Darling Gamma GOF Test</b>                          |                                         |                             |       |       |   |        |   |  |
| 2118 | 5% A-D Critical Value                                                                                                                    |   | 0.727  | Detected data appear Gamma Distributed at 5% Significance Level |                                         |                             |       |       |   |        |   |  |
| 2119 | K-S Test Statistic                                                                                                                       |   | 0.244  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |                                         |                             |       |       |   |        |   |  |
| 2120 | 5% K-S Critical Value                                                                                                                    |   | 0.281  | Detected data appear Gamma Distributed at 5% Significance Level |                                         |                             |       |       |   |        |   |  |
| 2121 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2122 |                                                                                                                                          |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2123 | <b>Gamma Statistics</b>                                                                                                                  |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2124 | k hat (MLE)                                                                                                                              |   | 2.908  | k star (bias corrected MLE)                                     |                                         | 2.013                       |       |       |   |        |   |  |
| 2125 | Theta hat (MLE)                                                                                                                          |   | 83.12  | Theta star (bias corrected MLE)                                 |                                         | 120.1                       |       |       |   |        |   |  |
| 2126 | nu hat (MLE)                                                                                                                             |   | 52.35  | nu star (bias corrected)                                        |                                         | 36.23                       |       |       |   |        |   |  |
| 2127 | MLE Mean (bias corrected)                                                                                                                |   | 241.7  | MLE Sd (bias corrected)                                         |                                         | 170.4                       |       |       |   |        |   |  |
| 2128 |                                                                                                                                          |   |        | Approximate Chi Square Value (0.05)                             |                                         | 23.45                       |       |       |   |        |   |  |
| 2129 | Adjusted Level of Significance                                                                                                           |   | 0.0231 | Adjusted Chi Square Value                                       |                                         | 21.31                       |       |       |   |        |   |  |
| 2130 |                                                                                                                                          |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2131 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2132 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |        | 373.4                                                           | 95% Adjusted Gamma UCL (use when n<50)  |                             |       | 411   |   |        |   |  |
| 2133 |                                                                                                                                          |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2134 | <b>Lognormal GOF Test</b>                                                                                                                |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2135 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.846  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |                                         |                             |       |       |   |        |   |  |
| 2136 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.829  | Data appear Lognormal at 5% Significance Level                  |                                         |                             |       |       |   |        |   |  |
| 2137 | Lilliefors Test Statistic                                                                                                                |   | 0.235  | <b>Lilliefors Lognormal GOF Test</b>                            |                                         |                             |       |       |   |        |   |  |
| 2138 | 5% Lilliefors Critical Value                                                                                                             |   | 0.274  | Data appear Lognormal at 5% Significance Level                  |                                         |                             |       |       |   |        |   |  |
| 2139 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2140 |                                                                                                                                          |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2141 | <b>Lognormal Statistics</b>                                                                                                              |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |
| 2142 | Minimum of Logged Data                                                                                                                   |   |        | 3.982                                                           | Mean of logged Data                     |                             |       | 5.306 |   |        |   |  |
| 2143 | Maximum of Logged Data                                                                                                                   |   |        | 5.974                                                           | SD of logged Data                       |                             |       | 0.698 |   |        |   |  |
| 2144 |                                                                                                                                          |   |        |                                                                 |                                         |                             |       |       |   |        |   |  |

| A    | B                                                                                                                                        | C | D     | E                                                               | F | G | H | I      | J | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|-------|-----------------------------------------------------------------|---|---|---|--------|---|---|---|--|
| 2145 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2146 | 95% H-UCL                                                                                                                                |   | 490.6 | 90% Chebyshev (MVUE) UCL                                        |   |   |   | 427.5  |   |   |   |  |
| 2147 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 508.2 | 97.5% Chebyshev (MVUE) UCL                                      |   |   |   | 620.3  |   |   |   |  |
| 2148 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 840.4 |                                                                 |   |   |   |        |   |   |   |  |
| 2149 |                                                                                                                                          |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2150 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2151 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2152 |                                                                                                                                          |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2153 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2154 | 95% CLT UCL                                                                                                                              |   | 313.7 | 95% Jackknife UCL                                               |   |   |   | 323.1  |   |   |   |  |
| 2155 | 95% Standard Bootstrap UCL                                                                                                               |   | 311.1 | 95% Bootstrap-t UCL                                             |   |   |   | 320.1  |   |   |   |  |
| 2156 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 300.6 | 95% Percentile Bootstrap UCL                                    |   |   |   | 309.4  |   |   |   |  |
| 2157 | 95% BCA Bootstrap UCL                                                                                                                    |   | 312   |                                                                 |   |   |   |        |   |   |   |  |
| 2158 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 373   | 95% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 432.5  |   |   |   |  |
| 2159 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 515   | 99% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 677.2  |   |   |   |  |
| 2160 |                                                                                                                                          |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2161 | <b>Suggested UCL to Use</b>                                                                                                              |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2162 | 95% Student's-t UCL                                                                                                                      |   | 323.1 |                                                                 |   |   |   |        |   |   |   |  |
| 2163 |                                                                                                                                          |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2164 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2165 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2166 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2167 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2168 |                                                                                                                                          |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2169 | <b>Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be</b>                 |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2170 | <b>reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.</b>                                       |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2171 |                                                                                                                                          |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2172 |                                                                                                                                          |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2173 | <b>Result (eu3_manganese_roadway)</b>                                                                                                    |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2174 |                                                                                                                                          |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2175 | <b>General Statistics</b>                                                                                                                |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2176 | Total Number of Observations                                                                                                             |   | 9     | Number of Distinct Observations                                 |   |   |   | 9      |   |   |   |  |
| 2177 |                                                                                                                                          |   |       | Number of Missing Observations                                  |   |   |   | 0      |   |   |   |  |
| 2178 | Minimum                                                                                                                                  |   | 424   | Mean                                                            |   |   |   | 809.1  |   |   |   |  |
| 2179 | Maximum                                                                                                                                  |   | 1180  | Median                                                          |   |   |   | 817    |   |   |   |  |
| 2180 | SD                                                                                                                                       |   | 204.7 | Std. Error of Mean                                              |   |   |   | 68.23  |   |   |   |  |
| 2181 | Coefficient of Variation                                                                                                                 |   | 0.253 | Skewness                                                        |   |   |   | -0.127 |   |   |   |  |
| 2182 |                                                                                                                                          |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2183 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2184 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2185 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2186 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2187 |                                                                                                                                          |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2188 | <b>Normal GOF Test</b>                                                                                                                   |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2189 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.957 | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |        |   |   |   |  |
| 2190 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.829 | Data appear Normal at 5% Significance Level                     |   |   |   |        |   |   |   |  |
| 2191 | Lilliefors Test Statistic                                                                                                                |   | 0.175 | <b>Lilliefors GOF Test</b>                                      |   |   |   |        |   |   |   |  |
| 2192 | 5% Lilliefors Critical Value                                                                                                             |   | 0.274 | Data appear Normal at 5% Significance Level                     |   |   |   |        |   |   |   |  |
| 2193 | <b>Data appear Normal at 5% Significance Level</b>                                                                                       |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2194 |                                                                                                                                          |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2195 | <b>Assuming Normal Distribution</b>                                                                                                      |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2196 | <b>95% Normal UCL</b>                                                                                                                    |   |       | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |   |        |   |   |   |  |
| 2197 | 95% Student's-t UCL                                                                                                                      |   | 936   | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |   | 918.2  |   |   |   |  |
| 2198 |                                                                                                                                          |   |       | 95% Modified-t UCL (Johnson-1978)                               |   |   |   | 935.5  |   |   |   |  |
| 2199 |                                                                                                                                          |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2200 | <b>Gamma GOF Test</b>                                                                                                                    |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2201 | A-D Test Statistic                                                                                                                       |   | 0.377 | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |   |        |   |   |   |  |
| 2202 | 5% A-D Critical Value                                                                                                                    |   | 0.721 | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |        |   |   |   |  |
| 2203 | K-S Test Statistic                                                                                                                       |   | 0.175 | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |   |        |   |   |   |  |
| 2204 | 5% K-S Critical Value                                                                                                                    |   | 0.279 | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |        |   |   |   |  |
| 2205 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2206 |                                                                                                                                          |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2207 | <b>Gamma Statistics</b>                                                                                                                  |   |       |                                                                 |   |   |   |        |   |   |   |  |
| 2208 | k hat (MLE)                                                                                                                              |   | 15.7  | k star (bias corrected MLE)                                     |   |   |   | 10.54  |   |   |   |  |
| 2209 | Theta hat (MLE)                                                                                                                          |   | 51.55 | Theta star (bias corrected MLE)                                 |   |   |   | 76.77  |   |   |   |  |
| 2210 | nu hat (MLE)                                                                                                                             |   | 282.5 | nu star (bias corrected)                                        |   |   |   | 189.7  |   |   |   |  |
| 2211 | MLE Mean (bias corrected)                                                                                                                |   | 809.1 | MLE Sd (bias corrected)                                         |   |   |   | 249.2  |   |   |   |  |

| A    | B                                                                                                                                                                                                                    | C | D | E | F      | G                                              | H | I | J | K      | L |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|--------|------------------------------------------------|---|---|---|--------|---|
| 2212 |                                                                                                                                                                                                                      |   |   |   |        | Approximate Chi Square Value (0.05)            |   |   |   | 158.8  |   |
| 2213 | Adjusted Level of Significance                                                                                                                                                                                       |   |   |   | 0.0231 | Adjusted Chi Square Value                      |   |   |   | 152.9  |   |
| 2214 |                                                                                                                                                                                                                      |   |   |   |        |                                                |   |   |   |        |   |
| 2215 | <b>Assuming Gamma Distribution</b>                                                                                                                                                                                   |   |   |   |        |                                                |   |   |   |        |   |
| 2216 | 95% Approximate Gamma UCL (use when n>=50))                                                                                                                                                                          |   |   |   | 966.3  | 95% Adjusted Gamma UCL (use when n<50)         |   |   |   | 1004   |   |
| 2217 |                                                                                                                                                                                                                      |   |   |   |        |                                                |   |   |   |        |   |
| 2218 | <b>Lognormal GOF Test</b>                                                                                                                                                                                            |   |   |   |        |                                                |   |   |   |        |   |
| 2219 | Shapiro Wilk Test Statistic                                                                                                                                                                                          |   |   |   | 0.905  | <b>Shapiro Wilk Lognormal GOF Test</b>         |   |   |   |        |   |
| 2220 | 5% Shapiro Wilk Critical Value                                                                                                                                                                                       |   |   |   | 0.829  | Data appear Lognormal at 5% Significance Level |   |   |   |        |   |
| 2221 | Lilliefors Test Statistic                                                                                                                                                                                            |   |   |   | 0.196  | <b>Lilliefors Lognormal GOF Test</b>           |   |   |   |        |   |
| 2222 | 5% Lilliefors Critical Value                                                                                                                                                                                         |   |   |   | 0.274  | Data appear Lognormal at 5% Significance Level |   |   |   |        |   |
| 2223 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                                                                                                |   |   |   |        |                                                |   |   |   |        |   |
| 2224 |                                                                                                                                                                                                                      |   |   |   |        |                                                |   |   |   |        |   |
| 2225 | <b>Lognormal Statistics</b>                                                                                                                                                                                          |   |   |   |        |                                                |   |   |   |        |   |
| 2226 | Minimum of Logged Data                                                                                                                                                                                               |   |   |   | 6.05   | Mean of logged Data                            |   |   |   | 6.664  |   |
| 2227 | Maximum of Logged Data                                                                                                                                                                                               |   |   |   | 7.073  | SD of logged Data                              |   |   |   | 0.28   |   |
| 2228 |                                                                                                                                                                                                                      |   |   |   |        |                                                |   |   |   |        |   |
| 2229 | <b>Assuming Lognormal Distribution</b>                                                                                                                                                                               |   |   |   |        |                                                |   |   |   |        |   |
| 2230 | 95% H-UCL                                                                                                                                                                                                            |   |   |   | 992.5  | 90% Chebyshev (MVUE) UCL                       |   |   |   | 1040   |   |
| 2231 | 95% Chebyshev (MVUE) UCL                                                                                                                                                                                             |   |   |   | 1143   | 97.5% Chebyshev (MVUE) UCL                     |   |   |   | 1287   |   |
| 2232 | 99% Chebyshev (MVUE) UCL                                                                                                                                                                                             |   |   |   | 1569   |                                                |   |   |   |        |   |
| 2233 |                                                                                                                                                                                                                      |   |   |   |        |                                                |   |   |   |        |   |
| 2234 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                                                                                                |   |   |   |        |                                                |   |   |   |        |   |
| 2235 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                                                                                                     |   |   |   |        |                                                |   |   |   |        |   |
| 2236 |                                                                                                                                                                                                                      |   |   |   |        |                                                |   |   |   |        |   |
| 2237 | <b>Nonparametric Distribution Free UCLs</b>                                                                                                                                                                          |   |   |   |        |                                                |   |   |   |        |   |
| 2238 | 95% CLT UCL                                                                                                                                                                                                          |   |   |   | 921.3  | 95% Jackknife UCL                              |   |   |   | 936    |   |
| 2239 | 95% Standard Bootstrap UCL                                                                                                                                                                                           |   |   |   | 915.6  | 95% Bootstrap-t UCL                            |   |   |   | 920.6  |   |
| 2240 | 95% Hall's Bootstrap UCL                                                                                                                                                                                             |   |   |   | 949.1  | 95% Percentile Bootstrap UCL                   |   |   |   | 911.1  |   |
| 2241 | 95% BCA Bootstrap UCL                                                                                                                                                                                                |   |   |   | 904.7  |                                                |   |   |   |        |   |
| 2242 | 90% Chebyshev(Mean, Sd) UCL                                                                                                                                                                                          |   |   |   | 1014   | 95% Chebyshev(Mean, Sd) UCL                    |   |   |   | 1106   |   |
| 2243 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                                                                                                        |   |   |   | 1235   | 99% Chebyshev(Mean, Sd) UCL                    |   |   |   | 1488   |   |
| 2244 |                                                                                                                                                                                                                      |   |   |   |        |                                                |   |   |   |        |   |
| 2245 | <b>Suggested UCL to Use</b>                                                                                                                                                                                          |   |   |   |        |                                                |   |   |   |        |   |
| 2246 | 95% Student's-t UCL                                                                                                                                                                                                  |   |   |   | 936    |                                                |   |   |   |        |   |
| 2247 |                                                                                                                                                                                                                      |   |   |   |        |                                                |   |   |   |        |   |
| 2248 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.                                                                                         |   |   |   |        |                                                |   |   |   |        |   |
| 2249 | Recommendations are based upon data size, data distribution, and skewness.                                                                                                                                           |   |   |   |        |                                                |   |   |   |        |   |
| 2250 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                                                                                             |   |   |   |        |                                                |   |   |   |        |   |
| 2251 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician                                                                             |   |   |   |        |                                                |   |   |   |        |   |
| 2252 |                                                                                                                                                                                                                      |   |   |   |        |                                                |   |   |   |        |   |
| 2253 | <b>Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.</b> |   |   |   |        |                                                |   |   |   |        |   |
| 2254 |                                                                                                                                                                                                                      |   |   |   |        |                                                |   |   |   |        |   |
| 2255 |                                                                                                                                                                                                                      |   |   |   |        |                                                |   |   |   |        |   |
| 2256 |                                                                                                                                                                                                                      |   |   |   |        |                                                |   |   |   |        |   |
| 2257 | <b>Result (eu3_thallium_roadway)</b>                                                                                                                                                                                 |   |   |   |        |                                                |   |   |   |        |   |
| 2258 |                                                                                                                                                                                                                      |   |   |   |        |                                                |   |   |   |        |   |
| 2259 | <b>General Statistics</b>                                                                                                                                                                                            |   |   |   |        |                                                |   |   |   |        |   |
| 2260 | Total Number of Observations                                                                                                                                                                                         |   |   |   | 9      | Number of Distinct Observations                |   |   |   | 8      |   |
| 2261 |                                                                                                                                                                                                                      |   |   |   |        | Number of Missing Observations                 |   |   |   | 0      |   |
| 2262 | Minimum                                                                                                                                                                                                              |   |   |   | 0.073  | Mean                                           |   |   |   | 0.138  |   |
| 2263 | Maximum                                                                                                                                                                                                              |   |   |   | 0.41   | Median                                         |   |   |   | 0.096  |   |
| 2264 | SD                                                                                                                                                                                                                   |   |   |   | 0.105  | Std. Error of Mean                             |   |   |   | 0.0349 |   |
| 2265 | Coefficient of Variation                                                                                                                                                                                             |   |   |   | 0.759  | Skewness                                       |   |   |   | 2.707  |   |
| 2266 |                                                                                                                                                                                                                      |   |   |   |        |                                                |   |   |   |        |   |
| 2267 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>           |   |   |   |        |                                                |   |   |   |        |   |
| 2268 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                                                                                                  |   |   |   |        |                                                |   |   |   |        |   |
| 2269 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                                                                                                       |   |   |   |        |                                                |   |   |   |        |   |
| 2270 |                                                                                                                                                                                                                      |   |   |   |        |                                                |   |   |   |        |   |
| 2271 |                                                                                                                                                                                                                      |   |   |   |        |                                                |   |   |   |        |   |
| 2272 | <b>Normal GOF Test</b>                                                                                                                                                                                               |   |   |   |        |                                                |   |   |   |        |   |
| 2273 | Shapiro Wilk Test Statistic                                                                                                                                                                                          |   |   |   | 0.6    | <b>Shapiro Wilk GOF Test</b>                   |   |   |   |        |   |
| 2274 | 5% Shapiro Wilk Critical Value                                                                                                                                                                                       |   |   |   | 0.829  | Data Not Normal at 5% Significance Level       |   |   |   |        |   |
| 2275 | Lilliefors Test Statistic                                                                                                                                                                                            |   |   |   | 0.381  | <b>Lilliefors GOF Test</b>                     |   |   |   |        |   |
| 2276 | 5% Lilliefors Critical Value                                                                                                                                                                                         |   |   |   | 0.274  | Data Not Normal at 5% Significance Level       |   |   |   |        |   |
| 2277 | <b>Data Not Normal at 5% Significance Level</b>                                                                                                                                                                      |   |   |   |        |                                                |   |   |   |        |   |
| 2278 |                                                                                                                                                                                                                      |   |   |   |        |                                                |   |   |   |        |   |

| A    | B                                                                                                                                        | C | D | E      | F | G                                                   | H | I | J | K      | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|---|-----------------------------------------------------|---|---|---|--------|---|
| 2279 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |        |   |                                                     |   |   |   |        |   |
| 2280 | <b>95% Normal UCL</b>                                                                                                                    |   |   |        |   | <b>95% UCLs (Adjusted for Skewness)</b>             |   |   |   |        |   |
| 2281 | 95% Student's-t UCL                                                                                                                      |   |   | 0.203  |   | 95% Adjusted-CLT UCL (Chen-1995)                    |   |   |   | 0.229  |   |
| 2282 |                                                                                                                                          |   |   |        |   | 95% Modified-t UCL (Johnson-1978)                   |   |   |   | 0.208  |   |
| 2283 |                                                                                                                                          |   |   |        |   |                                                     |   |   |   |        |   |
| 2284 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |        |   |                                                     |   |   |   |        |   |
| 2285 | A-D Test Statistic                                                                                                                       |   |   | 1.065  |   | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |   |        |   |
| 2286 | 5% A-D Critical Value                                                                                                                    |   |   | 0.726  |   | Data Not Gamma Distributed at 5% Significance Level |   |   |   |        |   |
| 2287 | K-S Test Statistic                                                                                                                       |   |   | 0.306  |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |   |        |   |
| 2288 | 5% K-S Critical Value                                                                                                                    |   |   | 0.281  |   | Data Not Gamma Distributed at 5% Significance Level |   |   |   |        |   |
| 2289 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |   |        |   |                                                     |   |   |   |        |   |
| 2290 |                                                                                                                                          |   |   |        |   |                                                     |   |   |   |        |   |
| 2291 | <b>Gamma Statistics</b>                                                                                                                  |   |   |        |   |                                                     |   |   |   |        |   |
| 2292 | k hat (MLE)                                                                                                                              |   |   | 3.408  |   | k star (bias corrected MLE)                         |   |   |   | 2.346  |   |
| 2293 | Theta hat (MLE)                                                                                                                          |   |   | 0.0405 |   | Theta star (bias corrected MLE)                     |   |   |   | 0.0588 |   |
| 2294 | nu hat (MLE)                                                                                                                             |   |   | 61.35  |   | nu star (bias corrected)                            |   |   |   | 42.23  |   |
| 2295 | MLE Mean (bias corrected)                                                                                                                |   |   | 0.138  |   | MLE Sd (bias corrected)                             |   |   |   | 0.0901 |   |
| 2296 |                                                                                                                                          |   |   |        |   | Approximate Chi Square Value (0.05)                 |   |   |   | 28.33  |   |
| 2297 | Adjusted Level of Significance                                                                                                           |   |   | 0.0231 |   | Adjusted Chi Square Value                           |   |   |   | 25.96  |   |
| 2298 |                                                                                                                                          |   |   |        |   |                                                     |   |   |   |        |   |
| 2299 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |        |   |                                                     |   |   |   |        |   |
| 2300 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |   | 0.206  |   | 95% Adjusted Gamma UCL (use when n<50)              |   |   |   | 0.225  |   |
| 2301 |                                                                                                                                          |   |   |        |   |                                                     |   |   |   |        |   |
| 2302 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |        |   |                                                     |   |   |   |        |   |
| 2303 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.789  |   | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |   |   |        |   |
| 2304 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.829  |   | Data Not Lognormal at 5% Significance Level         |   |   |   |        |   |
| 2305 | Lilliefors Test Statistic                                                                                                                |   |   | 0.262  |   | <b>Lilliefors Lognormal GOF Test</b>                |   |   |   |        |   |
| 2306 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.274  |   | Data appear Lognormal at 5% Significance Level      |   |   |   |        |   |
| 2307 | <b>Data appear Approximate Lognormal at 5% Significance Level</b>                                                                        |   |   |        |   |                                                     |   |   |   |        |   |
| 2308 |                                                                                                                                          |   |   |        |   |                                                     |   |   |   |        |   |
| 2309 | <b>Lognormal Statistics</b>                                                                                                              |   |   |        |   |                                                     |   |   |   |        |   |
| 2310 | Minimum of Logged Data                                                                                                                   |   |   | -2.617 |   | Mean of logged Data                                 |   |   |   | -2.134 |   |
| 2311 | Maximum of Logged Data                                                                                                                   |   |   | -0.892 |   | SD of logged Data                                   |   |   |   | 0.519  |   |
| 2312 |                                                                                                                                          |   |   |        |   |                                                     |   |   |   |        |   |
| 2313 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |        |   |                                                     |   |   |   |        |   |
| 2314 | 95% H-UCL                                                                                                                                |   |   | 0.205  |   | 90% Chebyshev (MVUE) UCL                            |   |   |   | 0.203  |   |
| 2315 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 0.235  |   | 97.5% Chebyshev (MVUE) UCL                          |   |   |   | 0.279  |   |
| 2316 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 0.366  |   |                                                     |   |   |   |        |   |
| 2317 |                                                                                                                                          |   |   |        |   |                                                     |   |   |   |        |   |
| 2318 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |   |                                                     |   |   |   |        |   |
| 2319 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |        |   |                                                     |   |   |   |        |   |
| 2320 |                                                                                                                                          |   |   |        |   |                                                     |   |   |   |        |   |
| 2321 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |        |   |                                                     |   |   |   |        |   |
| 2322 | 95% CLT UCL                                                                                                                              |   |   | 0.195  |   | 95% Jackknife UCL                                   |   |   |   | 0.203  |   |
| 2323 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 0.192  |   | 95% Bootstrap-t UCL                                 |   |   |   | 0.351  |   |
| 2324 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 0.412  |   | 95% Percentile Bootstrap UCL                        |   |   |   | 0.203  |   |
| 2325 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 0.233  |   |                                                     |   |   |   |        |   |
| 2326 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 0.243  |   | 95% Chebyshev(Mean, Sd) UCL                         |   |   |   | 0.29   |   |
| 2327 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 0.356  |   | 99% Chebyshev(Mean, Sd) UCL                         |   |   |   | 0.485  |   |
| 2328 |                                                                                                                                          |   |   |        |   |                                                     |   |   |   |        |   |
| 2329 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |   |                                                     |   |   |   |        |   |
| 2330 | 95% H-UCL                                                                                                                                |   |   | 0.205  |   |                                                     |   |   |   |        |   |
| 2331 |                                                                                                                                          |   |   |        |   |                                                     |   |   |   |        |   |
| 2332 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |   |                                                     |   |   |   |        |   |
| 2333 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |   |                                                     |   |   |   |        |   |
| 2334 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |   |                                                     |   |   |   |        |   |
| 2335 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |   |                                                     |   |   |   |        |   |
| 2336 |                                                                                                                                          |   |   |        |   |                                                     |   |   |   |        |   |
| 2337 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |   |   |        |   |                                                     |   |   |   |        |   |
| 2338 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |   |   |        |   |                                                     |   |   |   |        |   |
| 2339 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |   |   |        |   |                                                     |   |   |   |        |   |
| 2340 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |   |   |        |   |                                                     |   |   |   |        |   |
| 2341 |                                                                                                                                          |   |   |        |   |                                                     |   |   |   |        |   |
| 2342 |                                                                                                                                          |   |   |        |   |                                                     |   |   |   |        |   |
| 2343 | <b>Result (eu3_zinc_roadway)</b>                                                                                                         |   |   |        |   |                                                     |   |   |   |        |   |
| 2344 |                                                                                                                                          |   |   |        |   |                                                     |   |   |   |        |   |
| 2345 | <b>General Statistics</b>                                                                                                                |   |   |        |   |                                                     |   |   |   |        |   |

|      | A                                                                                                          | B | C | D | E | F      | G                                                               | H | I | J | K | L     |
|------|------------------------------------------------------------------------------------------------------------|---|---|---|---|--------|-----------------------------------------------------------------|---|---|---|---|-------|
| 2346 | Total Number of Observations                                                                               |   |   |   |   | 9      | Number of Distinct Observations                                 |   |   |   |   | 9     |
| 2347 |                                                                                                            |   |   |   |   |        | Number of Missing Observations                                  |   |   |   |   | 0     |
| 2348 | Minimum                                                                                                    |   |   |   |   | 130    | Mean                                                            |   |   |   |   | 468.7 |
| 2349 | Maximum                                                                                                    |   |   |   |   | 988    | Median                                                          |   |   |   |   | 380   |
| 2350 | SD                                                                                                         |   |   |   |   | 306.6  | Std. Error of Mean                                              |   |   |   |   | 102.2 |
| 2351 | Coefficient of Variation                                                                                   |   |   |   |   | 0.654  | Skewness                                                        |   |   |   |   | 0.849 |
| 2352 |                                                                                                            |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2353 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b> |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2354 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>     |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2355 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                        |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2356 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>             |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2357 |                                                                                                            |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2358 | <b>Normal GOF Test</b>                                                                                     |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2359 | Shapiro Wilk Test Statistic                                                                                |   |   |   |   | 0.891  | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |   |       |
| 2360 | 5% Shapiro Wilk Critical Value                                                                             |   |   |   |   | 0.829  | Data appear Normal at 5% Significance Level                     |   |   |   |   |       |
| 2361 | Lilliefors Test Statistic                                                                                  |   |   |   |   | 0.19   | <b>Lilliefors GOF Test</b>                                      |   |   |   |   |       |
| 2362 | 5% Lilliefors Critical Value                                                                               |   |   |   |   | 0.274  | Data appear Normal at 5% Significance Level                     |   |   |   |   |       |
| 2363 | <b>Data appear Normal at 5% Significance Level</b>                                                         |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2364 |                                                                                                            |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2365 | <b>Assuming Normal Distribution</b>                                                                        |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2366 | <b>95% Normal UCL</b>                                                                                      |   |   |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |   |   |       |
| 2367 | 95% Student's-t UCL                                                                                        |   |   |   |   | 658.7  | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |   |   | 667.6 |
| 2368 |                                                                                                            |   |   |   |   |        | 95% Modified-t UCL (Johnson-1978)                               |   |   |   |   | 663.5 |
| 2369 |                                                                                                            |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2370 | <b>Gamma GOF Test</b>                                                                                      |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2371 | A-D Test Statistic                                                                                         |   |   |   |   | 0.228  | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |   |   |       |
| 2372 | 5% A-D Critical Value                                                                                      |   |   |   |   | 0.728  | detected data appear Gamma Distributed at 5% Significance Level |   |   |   |   |       |
| 2373 | K-S Test Statistic                                                                                         |   |   |   |   | 0.144  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |   |   |       |
| 2374 | 5% K-S Critical Value                                                                                      |   |   |   |   | 0.282  | detected data appear Gamma Distributed at 5% Significance Level |   |   |   |   |       |
| 2375 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                     |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2376 |                                                                                                            |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2377 | <b>Gamma Statistics</b>                                                                                    |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2378 | k hat (MLE)                                                                                                |   |   |   |   | 2.655  | k star (bias corrected MLE)                                     |   |   |   |   | 1.844 |
| 2379 | Theta hat (MLE)                                                                                            |   |   |   |   | 176.6  | Theta star (bias corrected MLE)                                 |   |   |   |   | 254.2 |
| 2380 | nu hat (MLE)                                                                                               |   |   |   |   | 47.78  | nu star (bias corrected)                                        |   |   |   |   | 33.19 |
| 2381 | MLE Mean (bias corrected)                                                                                  |   |   |   |   | 468.7  | MLE Sd (bias corrected)                                         |   |   |   |   | 345.2 |
| 2382 |                                                                                                            |   |   |   |   |        | Approximate Chi Square Value (0.05)                             |   |   |   |   | 21.02 |
| 2383 | Adjusted Level of Significance                                                                             |   |   |   |   | 0.0231 | Adjusted Chi Square Value                                       |   |   |   |   | 19    |
| 2384 |                                                                                                            |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2385 | <b>Assuming Gamma Distribution</b>                                                                         |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2386 | 95% Approximate Gamma UCL (use when n>=50)                                                                 |   |   |   |   | 740.1  | 95% Adjusted Gamma UCL (use when n<50)                          |   |   |   |   | 818.7 |
| 2387 |                                                                                                            |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2388 | <b>Lognormal GOF Test</b>                                                                                  |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2389 | Shapiro Wilk Test Statistic                                                                                |   |   |   |   | 0.966  | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |   |   |       |
| 2390 | 5% Shapiro Wilk Critical Value                                                                             |   |   |   |   | 0.829  | Data appear Lognormal at 5% Significance Level                  |   |   |   |   |       |
| 2391 | Lilliefors Test Statistic                                                                                  |   |   |   |   | 0.119  | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |   |   |       |
| 2392 | 5% Lilliefors Critical Value                                                                               |   |   |   |   | 0.274  | Data appear Lognormal at 5% Significance Level                  |   |   |   |   |       |
| 2393 | <b>Data appear Lognormal at 5% Significance Level</b>                                                      |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2394 |                                                                                                            |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2395 | <b>Lognormal Statistics</b>                                                                                |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2396 | Minimum of Logged Data                                                                                     |   |   |   |   | 4.868  | Mean of logged Data                                             |   |   |   |   | 5.95  |
| 2397 | Maximum of Logged Data                                                                                     |   |   |   |   | 6.896  | SD of logged Data                                               |   |   |   |   | 0.688 |
| 2398 |                                                                                                            |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2399 | <b>Assuming Lognormal Distribution</b>                                                                     |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2400 | 95% H-UCL                                                                                                  |   |   |   |   | 914.1  | 90% Chebyshev (MVUE) UCL                                        |   |   |   |   | 803.3 |
| 2401 | 95% Chebyshev (MVUE) UCL                                                                                   |   |   |   |   | 953.7  | 97.5% Chebyshev (MVUE) UCL                                      |   |   |   |   | 1162  |
| 2402 | 99% Chebyshev (MVUE) UCL                                                                                   |   |   |   |   | 1572   |                                                                 |   |   |   |   |       |
| 2403 |                                                                                                            |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2404 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                      |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2405 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                           |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2406 |                                                                                                            |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2407 | <b>Nonparametric Distribution Free UCLs</b>                                                                |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 2408 | 95% CLT UCL                                                                                                |   |   |   |   | 636.7  | 95% Jackknife UCL                                               |   |   |   |   | 658.7 |
| 2409 | 95% Standard Bootstrap UCL                                                                                 |   |   |   |   | 627.9  | 95% Bootstrap-t UCL                                             |   |   |   |   | 724.8 |
| 2410 | 95% Hall's Bootstrap UCL                                                                                   |   |   |   |   | 807.4  | 95% Percentile Bootstrap UCL                                    |   |   |   |   | 632.1 |
| 2411 | 95% BCA Bootstrap UCL                                                                                      |   |   |   |   | 657.8  |                                                                 |   |   |   |   |       |
| 2412 | 90% Chebyshev(Mean, Sd) UCL                                                                                |   |   |   |   | 775.2  | 95% Chebyshev(Mean, Sd) UCL                                     |   |   |   |   | 914.1 |

| A    | B                                                                                                                                        | C | D | E      | F                                                               | G | H | I      | J | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------------------|---|---|--------|---|---|---|--|
| 2413 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 1107   | 99% Chebyshev(Mean, Sd) UCL                                     |   |   | 1485   |   |   |   |  |
| 2414 |                                                                                                                                          |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2415 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2416 | 95% Student's-t UCL                                                                                                                      |   |   | 658.7  |                                                                 |   |   |        |   |   |   |  |
| 2417 |                                                                                                                                          |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2418 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2419 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2420 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2421 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2422 |                                                                                                                                          |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2423 | <b>Result (eu4_antimony_roadway)</b>                                                                                                     |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2424 |                                                                                                                                          |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2425 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2426 | Total Number of Observations                                                                                                             |   |   | 7      | Number of Distinct Observations                                 |   |   | 7      |   |   |   |  |
| 2427 | Number of Detects                                                                                                                        |   |   | 6      | Number of Non-Detects                                           |   |   | 1      |   |   |   |  |
| 2428 | Number of Distinct Detects                                                                                                               |   |   | 6      | Number of Distinct Non-Detects                                  |   |   | 1      |   |   |   |  |
| 2429 | Minimum Detect                                                                                                                           |   |   | 0.21   | Minimum Non-Detect                                              |   |   | 1.1    |   |   |   |  |
| 2430 | Maximum Detect                                                                                                                           |   |   | 0.8    | Maximum Non-Detect                                              |   |   | 1.1    |   |   |   |  |
| 2431 | Variance Detects                                                                                                                         |   |   | 0.0461 | Percent Non-Detects                                             |   |   | 14.29% |   |   |   |  |
| 2432 | Mean Detects                                                                                                                             |   |   | 0.492  | SD Detects                                                      |   |   | 0.215  |   |   |   |  |
| 2433 | Median Detects                                                                                                                           |   |   | 0.495  | CV Detects                                                      |   |   | 0.437  |   |   |   |  |
| 2434 | Skewness Detects                                                                                                                         |   |   | 0.129  | Kurtosis Detects                                                |   |   | -0.69  |   |   |   |  |
| 2435 | Mean of Logged Detects                                                                                                                   |   |   | -0.802 | SD of Logged Detects                                            |   |   | 0.489  |   |   |   |  |
| 2436 |                                                                                                                                          |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2437 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2438 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2439 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2440 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2441 |                                                                                                                                          |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2442 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2443 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.984  | <b>Shapiro Wilk GOF Test</b>                                    |   |   |        |   |   |   |  |
| 2444 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.788  | Detected Data appear Normal at 5% Significance Level            |   |   |        |   |   |   |  |
| 2445 | Lilliefors Test Statistic                                                                                                                |   |   | 0.134  | <b>Lilliefors GOF Test</b>                                      |   |   |        |   |   |   |  |
| 2446 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.325  | Detected Data appear Normal at 5% Significance Level            |   |   |        |   |   |   |  |
| 2447 | <b>Detected Data appear Normal at 5% Significance Level</b>                                                                              |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2448 |                                                                                                                                          |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2449 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2450 | KM Mean                                                                                                                                  |   |   | 0.492  | KM Standard Error of Mean                                       |   |   | 0.0877 |   |   |   |  |
| 2451 | KM SD                                                                                                                                    |   |   | 0.196  | 95% KM (BCA) UCL                                                |   |   | 0.62   |   |   |   |  |
| 2452 | 95% KM (t) UCL                                                                                                                           |   |   | 0.662  | 95% KM (Percentile Bootstrap) UCL                               |   |   | 0.624  |   |   |   |  |
| 2453 | 95% KM (z) UCL                                                                                                                           |   |   | 0.636  | 95% KM Bootstrap t UCL                                          |   |   | 0.666  |   |   |   |  |
| 2454 | 90% KM Chebyshev UCL                                                                                                                     |   |   | 0.755  | 95% KM Chebyshev UCL                                            |   |   | 0.874  |   |   |   |  |
| 2455 | 97.5% KM Chebyshev UCL                                                                                                                   |   |   | 1.039  | 99% KM Chebyshev UCL                                            |   |   | 1.364  |   |   |   |  |
| 2456 |                                                                                                                                          |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2457 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2458 | A-D Test Statistic                                                                                                                       |   |   | 0.197  | <b>Anderson-Darling GOF Test</b>                                |   |   |        |   |   |   |  |
| 2459 | 5% A-D Critical Value                                                                                                                    |   |   | 0.698  | detected data appear Gamma Distributed at 5% Significance Level |   |   |        |   |   |   |  |
| 2460 | K-S Test Statistic                                                                                                                       |   |   | 0.181  | <b>Kolmogorov-Smirnov GOF</b>                                   |   |   |        |   |   |   |  |
| 2461 | 5% K-S Critical Value                                                                                                                    |   |   | 0.333  | detected data appear Gamma Distributed at 5% Significance Level |   |   |        |   |   |   |  |
| 2462 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2463 |                                                                                                                                          |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2464 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2465 | k hat (MLE)                                                                                                                              |   |   | 5.611  | k star (bias corrected MLE)                                     |   |   | 2.917  |   |   |   |  |
| 2466 | Theta hat (MLE)                                                                                                                          |   |   | 0.0876 | Theta star (bias corrected MLE)                                 |   |   | 0.169  |   |   |   |  |
| 2467 | nu hat (MLE)                                                                                                                             |   |   | 67.33  | nu star (bias corrected)                                        |   |   | 35     |   |   |   |  |
| 2468 | Mean (detects)                                                                                                                           |   |   | 0.492  |                                                                 |   |   |        |   |   |   |  |
| 2469 |                                                                                                                                          |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2470 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2471 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2472 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2473 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2474 | This is especially true when the sample size is small.                                                                                   |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2475 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |   |   |        |                                                                 |   |   |        |   |   |   |  |
| 2476 | Minimum                                                                                                                                  |   |   | 0.21   | Mean                                                            |   |   | 0.489  |   |   |   |  |
| 2477 | Maximum                                                                                                                                  |   |   | 0.8    | Median                                                          |   |   | 0.472  |   |   |   |  |
| 2478 | SD                                                                                                                                       |   |   | 0.196  | CV                                                              |   |   | 0.401  |   |   |   |  |
| 2479 | k hat (MLE)                                                                                                                              |   |   | 6.512  | k star (bias corrected MLE)                                     |   |   | 3.816  |   |   |   |  |

| A    | B | C | D | E                                                                                                                                       | F      | G | H | I                           | J                                                       | K | L      |
|------|---|---|---|-----------------------------------------------------------------------------------------------------------------------------------------|--------|---|---|-----------------------------|---------------------------------------------------------|---|--------|
| 2480 |   |   |   | Theta hat (MLE)                                                                                                                         | 0.0751 |   |   |                             | Theta star (bias corrected MLE)                         |   | 0.128  |
| 2481 |   |   |   | nu hat (MLE)                                                                                                                            | 91.17  |   |   |                             | nu star (bias corrected)                                |   | 53.43  |
| 2482 |   |   |   | Adjusted Level of Significance ( $\beta$ )                                                                                              | 0.0158 |   |   |                             |                                                         |   |        |
| 2483 |   |   |   | Approximate Chi Square Value (53.43, $\alpha$ )                                                                                         | 37.64  |   |   |                             | Adjusted Chi Square Value (53.43, $\beta$ )             |   | 33.68  |
| 2484 |   |   |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                                       | 0.694  |   |   |                             | 95% Gamma Adjusted UCL (use when $n < 50$ )             |   | 0.776  |
| 2485 |   |   |   | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                 |        |   |   |                             |                                                         |   |        |
| 2486 |   |   |   | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                 |        |   |   |                             |                                                         |   |        |
| 2487 |   |   |   | Mean (KM)                                                                                                                               | 0.492  |   |   |                             | SD (KM)                                                 |   | 0.196  |
| 2488 |   |   |   | Variance (KM)                                                                                                                           | 0.0384 |   |   |                             | SE of Mean (KM)                                         |   | 0.0877 |
| 2489 |   |   |   | k hat (KM)                                                                                                                              | 6.287  |   |   |                             | k star (KM)                                             |   | 3.688  |
| 2490 |   |   |   | nu hat (KM)                                                                                                                             | 88.02  |   |   |                             | nu star (KM)                                            |   | 51.63  |
| 2491 |   |   |   | theta hat (KM)                                                                                                                          | 0.0782 |   |   |                             | theta star (KM)                                         |   | 0.133  |
| 2492 |   |   |   | 80% gamma percentile (KM)                                                                                                               | 0.684  |   |   |                             | 90% gamma percentile (KM)                               |   | 0.835  |
| 2493 |   |   |   | 95% gamma percentile (KM)                                                                                                               | 0.974  |   |   |                             | 99% gamma percentile (KM)                               |   | 1.272  |
| 2494 |   |   |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                               |        |   |   |                             |                                                         |   |        |
| 2495 |   |   |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                               |        |   |   |                             |                                                         |   |        |
| 2496 |   |   |   | Approximate Chi Square Value (51.63, $\alpha$ )                                                                                         | 36.13  |   |   |                             | Adjusted Chi Square Value (51.63, $\beta$ )             |   | 32.26  |
| 2497 |   |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                     | 0.703  |   |   |                             | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )          |   | 0.787  |
| 2498 |   |   |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                 |        |   |   |                             |                                                         |   |        |
| 2499 |   |   |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                 |        |   |   |                             |                                                         |   |        |
| 2500 |   |   |   | Shapiro Wilk Test Statistic                                                                                                             | 0.96   |   |   |                             | <b>Shapiro Wilk GOF Test</b>                            |   |        |
| 2501 |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                          | 0.788  |   |   |                             | Detected Data appear Lognormal at 5% Significance Level |   |        |
| 2502 |   |   |   | Lilliefors Test Statistic                                                                                                               | 0.205  |   |   |                             | <b>Lilliefors GOF Test</b>                              |   |        |
| 2503 |   |   |   | 5% Lilliefors Critical Value                                                                                                            | 0.325  |   |   |                             | Detected Data appear Lognormal at 5% Significance Level |   |        |
| 2504 |   |   |   | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                          |        |   |   |                             |                                                         |   |        |
| 2505 |   |   |   | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                          |        |   |   |                             |                                                         |   |        |
| 2506 |   |   |   | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                               |        |   |   |                             |                                                         |   |        |
| 2507 |   |   |   | Mean in Original Scale                                                                                                                  | 0.486  |   |   |                             | Mean in Log Scale                                       |   | -0.802 |
| 2508 |   |   |   | SD in Original Scale                                                                                                                    | 0.197  |   |   |                             | SD in Log Scale                                         |   | 0.447  |
| 2509 |   |   |   | 95% t UCL (assumes normality of ROS data)                                                                                               | 0.63   |   |   |                             | 95% Percentile Bootstrap UCL                            |   | 0.604  |
| 2510 |   |   |   | 95% BCA Bootstrap UCL                                                                                                                   | 0.607  |   |   |                             | 95% Bootstrap t UCL                                     |   | 0.646  |
| 2511 |   |   |   | 95% H-UCL (Log ROS)                                                                                                                     | 0.761  |   |   |                             |                                                         |   |        |
| 2512 |   |   |   | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                 |        |   |   |                             |                                                         |   |        |
| 2513 |   |   |   | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                 |        |   |   |                             |                                                         |   |        |
| 2514 |   |   |   | KM Mean (logged)                                                                                                                        | -0.802 |   |   |                             | KM Geo Mean                                             |   | 0.449  |
| 2515 |   |   |   | KM SD (logged)                                                                                                                          | 0.447  |   |   |                             | 95% Critical H Value (KM-Log)                           |   | 2.353  |
| 2516 |   |   |   | KM Standard Error of Mean (logged)                                                                                                      | 0.2    |   |   |                             | 95% H-UCL (KM -Log)                                     |   | 0.761  |
| 2517 |   |   |   | KM SD (logged)                                                                                                                          | 0.447  |   |   |                             | 95% Critical H Value (KM-Log)                           |   | 2.353  |
| 2518 |   |   |   | KM Standard Error of Mean (logged)                                                                                                      | 0.2    |   |   |                             |                                                         |   |        |
| 2519 |   |   |   | <b>DL/2 Statistics</b>                                                                                                                  |        |   |   |                             |                                                         |   |        |
| 2520 |   |   |   | <b>DL/2 Statistics</b>                                                                                                                  |        |   |   |                             |                                                         |   |        |
| 2521 |   |   |   | <b>DL/2 Normal</b>                                                                                                                      |        |   |   | <b>DL/2 Log-Transformed</b> |                                                         |   |        |
| 2522 |   |   |   | Mean in Original Scale                                                                                                                  | 0.5    |   |   |                             | Mean in Log Scale                                       |   | -0.773 |
| 2523 |   |   |   | SD in Original Scale                                                                                                                    | 0.197  |   |   |                             | SD in Log Scale                                         |   | 0.453  |
| 2524 |   |   |   | 95% t UCL (Assumes normality)                                                                                                           | 0.645  |   |   |                             | 95% H-Stat UCL                                          |   | 0.793  |
| 2525 |   |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                |        |   |   |                             |                                                         |   |        |
| 2526 |   |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                |        |   |   |                             |                                                         |   |        |
| 2527 |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                   |        |   |   |                             |                                                         |   |        |
| 2528 |   |   |   | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                 |        |   |   |                             |                                                         |   |        |
| 2529 |   |   |   | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                 |        |   |   |                             |                                                         |   |        |
| 2530 |   |   |   | <b>Suggested UCL to Use</b>                                                                                                             |        |   |   |                             |                                                         |   |        |
| 2531 |   |   |   | 95% KM (t) UCL                                                                                                                          | 0.662  |   |   |                             |                                                         |   |        |
| 2532 |   |   |   | <b>Suggested UCL to Use</b>                                                                                                             |        |   |   |                             |                                                         |   |        |
| 2533 |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.            |        |   |   |                             |                                                         |   |        |
| 2534 |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                              |        |   |   |                             |                                                         |   |        |
| 2535 |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                |        |   |   |                             |                                                         |   |        |
| 2536 |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statisticia |        |   |   |                             |                                                         |   |        |
| 2537 |   |   |   |                                                                                                                                         |        |   |   |                             |                                                         |   |        |
| 2538 |   |   |   |                                                                                                                                         |        |   |   |                             |                                                         |   |        |
| 2539 |   |   |   | <b>Result (eu4_arsenic_roadway)</b>                                                                                                     |        |   |   |                             |                                                         |   |        |
| 2540 |   |   |   | <b>Result (eu4_arsenic_roadway)</b>                                                                                                     |        |   |   |                             |                                                         |   |        |
| 2541 |   |   |   | <b>General Statistics</b>                                                                                                               |        |   |   |                             |                                                         |   |        |
| 2542 |   |   |   | Total Number of Observations                                                                                                            | 7      |   |   |                             | Number of Distinct Observations                         |   | 7      |
| 2543 |   |   |   |                                                                                                                                         |        |   |   |                             | Number of Missing Observations                          |   | 0      |
| 2544 |   |   |   | Minimum                                                                                                                                 | 4.1    |   |   |                             | Mean                                                    |   | 10.86  |
| 2545 |   |   |   | Maximum                                                                                                                                 | 23     |   |   |                             | Median                                                  |   | 9.6    |
| 2546 |   |   |   | SD                                                                                                                                      | 6.178  |   |   |                             | Std. Error of Mean                                      |   | 2.335  |

| A    | B                                                                                                          | C | D | E | F                                       | G                                                               | H | I | J | K     | L |
|------|------------------------------------------------------------------------------------------------------------|---|---|---|-----------------------------------------|-----------------------------------------------------------------|---|---|---|-------|---|
| 2547 | Coefficient of Variation                                                                                   |   |   |   | 0.569                                   | Skewness                                                        |   |   |   | 1.316 |   |
| 2548 |                                                                                                            |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2549 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b> |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2550 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>     |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2551 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                        |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2552 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>             |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2553 |                                                                                                            |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2554 | <b>Normal GOF Test</b>                                                                                     |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2555 | Shapiro Wilk Test Statistic                                                                                |   |   |   | 0.886                                   | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |       |   |
| 2556 | 5% Shapiro Wilk Critical Value                                                                             |   |   |   | 0.803                                   | Data appear Normal at 5% Significance Level                     |   |   |   |       |   |
| 2557 | Lilliefors Test Statistic                                                                                  |   |   |   | 0.246                                   | <b>Lilliefors GOF Test</b>                                      |   |   |   |       |   |
| 2558 | 5% Lilliefors Critical Value                                                                               |   |   |   | 0.304                                   | Data appear Normal at 5% Significance Level                     |   |   |   |       |   |
| 2559 | <b>Data appear Normal at 5% Significance Level</b>                                                         |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2560 |                                                                                                            |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2561 | <b>Assuming Normal Distribution</b>                                                                        |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2562 | <b>95% Normal UCL</b>                                                                                      |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |                                                                 |   |   |   |       |   |
| 2563 | 95% Student's-t UCL                                                                                        |   |   |   | 15.39                                   | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |   | 15.94 |   |
| 2564 |                                                                                                            |   |   |   |                                         | 95% Modified-t UCL (Johnson-1978)                               |   |   |   | 15.59 |   |
| 2565 |                                                                                                            |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2566 | <b>Gamma GOF Test</b>                                                                                      |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2567 | A-D Test Statistic                                                                                         |   |   |   | 0.273                                   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |   |       |   |
| 2568 | 5% A-D Critical Value                                                                                      |   |   |   | 0.71                                    | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |       |   |
| 2569 | K-S Test Statistic                                                                                         |   |   |   | 0.18                                    | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |   |       |   |
| 2570 | 5% K-S Critical Value                                                                                      |   |   |   | 0.313                                   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |       |   |
| 2571 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                     |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2572 |                                                                                                            |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2573 | <b>Gamma Statistics</b>                                                                                    |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2574 | k hat (MLE)                                                                                                |   |   |   | 3.897                                   | k star (bias corrected MLE)                                     |   |   |   | 2.322 |   |
| 2575 | Theta hat (MLE)                                                                                            |   |   |   | 2.786                                   | Theta star (bias corrected MLE)                                 |   |   |   | 4.675 |   |
| 2576 | nu hat (MLE)                                                                                               |   |   |   | 54.56                                   | nu star (bias corrected)                                        |   |   |   | 32.51 |   |
| 2577 | MLE Mean (bias corrected)                                                                                  |   |   |   | 10.86                                   | MLE Sd (bias corrected)                                         |   |   |   | 7.124 |   |
| 2578 |                                                                                                            |   |   |   |                                         | Approximate Chi Square Value (0.05)                             |   |   |   | 20.48 |   |
| 2579 | Adjusted Level of Significance                                                                             |   |   |   | 0.0158                                  | Adjusted Chi Square Value                                       |   |   |   | 17.66 |   |
| 2580 |                                                                                                            |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2581 | <b>Assuming Gamma Distribution</b>                                                                         |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2582 | 95% Approximate Gamma UCL (use when n>=50))                                                                |   |   |   | 17.24                                   | 95% Adjusted Gamma UCL (use when n<50)                          |   |   |   | 19.99 |   |
| 2583 |                                                                                                            |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2584 | <b>Lognormal GOF Test</b>                                                                                  |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2585 | Shapiro Wilk Test Statistic                                                                                |   |   |   | 0.962                                   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |   |       |   |
| 2586 | 5% Shapiro Wilk Critical Value                                                                             |   |   |   | 0.803                                   | Data appear Lognormal at 5% Significance Level                  |   |   |   |       |   |
| 2587 | Lilliefors Test Statistic                                                                                  |   |   |   | 0.214                                   | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |   |       |   |
| 2588 | 5% Lilliefors Critical Value                                                                               |   |   |   | 0.304                                   | Data appear Lognormal at 5% Significance Level                  |   |   |   |       |   |
| 2589 | <b>Data appear Lognormal at 5% Significance Level</b>                                                      |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2590 |                                                                                                            |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2591 | <b>Lognormal Statistics</b>                                                                                |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2592 | Minimum of Logged Data                                                                                     |   |   |   | 1.411                                   | Mean of logged Data                                             |   |   |   | 2.251 |   |
| 2593 | Maximum of Logged Data                                                                                     |   |   |   | 3.135                                   | SD of logged Data                                               |   |   |   | 0.564 |   |
| 2594 |                                                                                                            |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2595 | <b>Assuming Lognormal Distribution</b>                                                                     |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2596 | 95% H-UCL                                                                                                  |   |   |   | 20.25                                   | 90% Chebyshev (MVUE) UCL                                        |   |   |   | 17.85 |   |
| 2597 | 95% Chebyshev (MVUE) UCL                                                                                   |   |   |   | 21.02                                   | 97.5% Chebyshev (MVUE) UCL                                      |   |   |   | 25.41 |   |
| 2598 | 99% Chebyshev (MVUE) UCL                                                                                   |   |   |   | 34.04                                   |                                                                 |   |   |   |       |   |
| 2599 |                                                                                                            |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2600 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                      |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2601 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                           |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2602 |                                                                                                            |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2603 | <b>Nonparametric Distribution Free UCLs</b>                                                                |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2604 | 95% CLT UCL                                                                                                |   |   |   | 14.7                                    | 95% Jackknife UCL                                               |   |   |   | 15.39 |   |
| 2605 | 95% Standard Bootstrap UCL                                                                                 |   |   |   | 14.47                                   | 95% Bootstrap-t UCL                                             |   |   |   | 17.21 |   |
| 2606 | 95% Hall's Bootstrap UCL                                                                                   |   |   |   | 33.78                                   | 95% Percentile Bootstrap UCL                                    |   |   |   | 14.69 |   |
| 2607 | 95% BCA Bootstrap UCL                                                                                      |   |   |   | 15.14                                   |                                                                 |   |   |   |       |   |
| 2608 | 90% Chebyshev(Mean, Sd) UCL                                                                                |   |   |   | 17.86                                   | 95% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 21.03 |   |
| 2609 | 97.5% Chebyshev(Mean, Sd) UCL                                                                              |   |   |   | 25.44                                   | 99% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 34.09 |   |
| 2610 |                                                                                                            |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2611 | <b>Suggested UCL to Use</b>                                                                                |   |   |   |                                         |                                                                 |   |   |   |       |   |
| 2612 | 95% Student's-t UCL                                                                                        |   |   |   | 15.39                                   |                                                                 |   |   |   |       |   |
| 2613 |                                                                                                            |   |   |   |                                         |                                                                 |   |   |   |       |   |

| A    | B                                                                                                                                        | C      | D | E | F                                       | G                                                   | H      | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------|---|---|-----------------------------------------|-----------------------------------------------------|--------|---|---|---|---|
| 2614 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2615 | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2616 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2617 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2618 |                                                                                                                                          |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2619 |                                                                                                                                          |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2620 | <b>Result (eu4_cadmium_roadway)</b>                                                                                                      |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2621 |                                                                                                                                          |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2622 | <b>General Statistics</b>                                                                                                                |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2623 | Total Number of Observations                                                                                                             | 7      |   |   |                                         | Number of Distinct Observations                     | 7      |   |   |   |   |
| 2624 |                                                                                                                                          |        |   |   |                                         | Number of Missing Observations                      | 0      |   |   |   |   |
| 2625 | Minimum                                                                                                                                  | 0.045  |   |   |                                         | Mean                                                | 6.047  |   |   |   |   |
| 2626 | Maximum                                                                                                                                  | 41.5   |   |   |                                         | Median                                              | 0.14   |   |   |   |   |
| 2627 | SD                                                                                                                                       | 15.63  |   |   |                                         | Std. Error of Mean                                  | 5.909  |   |   |   |   |
| 2628 | Coefficient of Variation                                                                                                                 | 2.585  |   |   |                                         | Skewness                                            | 2.646  |   |   |   |   |
| 2629 |                                                                                                                                          |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2630 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2631 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2632 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2633 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2634 |                                                                                                                                          |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2635 | <b>Normal GOF Test</b>                                                                                                                   |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2636 | Shapiro Wilk Test Statistic                                                                                                              | 0.458  |   |   |                                         | <b>Shapiro Wilk GOF Test</b>                        |        |   |   |   |   |
| 2637 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.803  |   |   |                                         | Data Not Normal at 5% Significance Level            |        |   |   |   |   |
| 2638 | Lilliefors Test Statistic                                                                                                                | 0.5    |   |   |                                         | <b>Lilliefors GOF Test</b>                          |        |   |   |   |   |
| 2639 | 5% Lilliefors Critical Value                                                                                                             | 0.304  |   |   |                                         | Data Not Normal at 5% Significance Level            |        |   |   |   |   |
| 2640 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2641 |                                                                                                                                          |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2642 | <b>Assuming Normal Distribution</b>                                                                                                      |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2643 | <b>95% Normal UCL</b>                                                                                                                    |        |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |                                                     |        |   |   |   |   |
| 2644 | 95% Student's-t UCL                                                                                                                      | 17.53  |   |   |                                         | 95% Adjusted-CLT UCL (Chen-1995)                    | 22.08  |   |   |   |   |
| 2645 |                                                                                                                                          |        |   |   |                                         | 95% Modified-t UCL (Johnson-1978)                   | 18.51  |   |   |   |   |
| 2646 |                                                                                                                                          |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2647 | <b>Gamma GOF Test</b>                                                                                                                    |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2648 | A-D Test Statistic                                                                                                                       | 1.568  |   |   |                                         | <b>Anderson-Darling Gamma GOF Test</b>              |        |   |   |   |   |
| 2649 | 5% A-D Critical Value                                                                                                                    | 0.811  |   |   |                                         | Data Not Gamma Distributed at 5% Significance Level |        |   |   |   |   |
| 2650 | K-S Test Statistic                                                                                                                       | 0.464  |   |   |                                         | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |        |   |   |   |   |
| 2651 | 5% K-S Critical Value                                                                                                                    | 0.34   |   |   |                                         | Data Not Gamma Distributed at 5% Significance Level |        |   |   |   |   |
| 2652 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2653 |                                                                                                                                          |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2654 | <b>Gamma Statistics</b>                                                                                                                  |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2655 | k hat (MLE)                                                                                                                              | 0.231  |   |   |                                         | k star (bias corrected MLE)                         | 0.227  |   |   |   |   |
| 2656 | Theta hat (MLE)                                                                                                                          | 26.19  |   |   |                                         | Theta star (bias corrected MLE)                     | 26.62  |   |   |   |   |
| 2657 | nu hat (MLE)                                                                                                                             | 3.233  |   |   |                                         | nu star (bias corrected)                            | 3.181  |   |   |   |   |
| 2658 | MLE Mean (bias corrected)                                                                                                                | 6.047  |   |   |                                         | MLE Sd (bias corrected)                             | 12.69  |   |   |   |   |
| 2659 |                                                                                                                                          |        |   |   |                                         | Approximate Chi Square Value (0.05)                 | 0.428  |   |   |   |   |
| 2660 | Adjusted Level of Significance                                                                                                           | 0.0158 |   |   |                                         | Adjusted Chi Square Value                           | 0.222  |   |   |   |   |
| 2661 |                                                                                                                                          |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2662 | <b>Assuming Gamma Distribution</b>                                                                                                       |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2663 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | 44.95  |   |   |                                         | 95% Adjusted Gamma UCL (use when n<50)              | 86.75  |   |   |   |   |
| 2664 |                                                                                                                                          |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2665 | <b>Lognormal GOF Test</b>                                                                                                                |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2666 | Shapiro Wilk Test Statistic                                                                                                              | 0.706  |   |   |                                         | <b>Shapiro Wilk Lognormal GOF Test</b>              |        |   |   |   |   |
| 2667 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.803  |   |   |                                         | Data Not Lognormal at 5% Significance Level         |        |   |   |   |   |
| 2668 | Lilliefors Test Statistic                                                                                                                | 0.332  |   |   |                                         | <b>Lilliefors Lognormal GOF Test</b>                |        |   |   |   |   |
| 2669 | 5% Lilliefors Critical Value                                                                                                             | 0.304  |   |   |                                         | Data Not Lognormal at 5% Significance Level         |        |   |   |   |   |
| 2670 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2671 |                                                                                                                                          |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2672 | <b>Lognormal Statistics</b>                                                                                                              |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2673 | Minimum of Logged Data                                                                                                                   | -3.101 |   |   |                                         | Mean of logged Data                                 | -1.316 |   |   |   |   |
| 2674 | Maximum of Logged Data                                                                                                                   | 3.726  |   |   |                                         | SD of logged Data                                   | 2.304  |   |   |   |   |
| 2675 |                                                                                                                                          |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2676 | <b>Assuming Lognormal Distribution</b>                                                                                                   |        |   |   |                                         |                                                     |        |   |   |   |   |
| 2677 | 95% H-UCL                                                                                                                                | 5383   |   |   |                                         | 90% Chebyshev (MVUE) UCL                            | 5.661  |   |   |   |   |
| 2678 | 95% Chebyshev (MVUE) UCL                                                                                                                 | 7.448  |   |   |                                         | 97.5% Chebyshev (MVUE) UCL                          | 9.927  |   |   |   |   |
| 2679 | 99% Chebyshev (MVUE) UCL                                                                                                                 | 14.8   |   |   |                                         |                                                     |        |   |   |   |   |
| 2680 |                                                                                                                                          |        |   |   |                                         |                                                     |        |   |   |   |   |

| A    | B                                                                                                                                        | C | D      | E | F                                                   | G | H     | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|---|-----------------------------------------------------|---|-------|---|---|---|---|
| 2681 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |        |   |                                                     |   |       |   |   |   |   |
| 2682 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |   |        |   |                                                     |   |       |   |   |   |   |
| 2683 |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 2684 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |        |   |                                                     |   |       |   |   |   |   |
| 2685 | 95% CLT UCL                                                                                                                              |   | 15.77  |   | 95% Jackknife UCL                                   |   | 17.53 |   |   |   |   |
| 2686 | 95% Standard Bootstrap UCL                                                                                                               |   | 14.95  |   | 95% Bootstrap-t UCL                                 |   | 2136  |   |   |   |   |
| 2687 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 932.4  |   | 95% Percentile Bootstrap UCL                        |   | 17.85 |   |   |   |   |
| 2688 | 95% BCA Bootstrap UCL                                                                                                                    |   | 23.75  |   |                                                     |   |       |   |   |   |   |
| 2689 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 23.77  |   | 95% Chebyshev(Mean, Sd) UCL                         |   | 31.8  |   |   |   |   |
| 2690 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 42.95  |   | 99% Chebyshev(Mean, Sd) UCL                         |   | 64.84 |   |   |   |   |
| 2691 |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 2692 | <b>Suggested UCL to Use</b>                                                                                                              |   |        |   |                                                     |   |       |   |   |   |   |
| 2693 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 932.4  |   |                                                     |   |       |   |   |   |   |
| 2694 |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 2695 | <b>Recommended UCL exceeds the maximum observation</b>                                                                                   |   |        |   |                                                     |   |       |   |   |   |   |
| 2696 |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 2697 | <b>Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL</b>        |   |        |   |                                                     |   |       |   |   |   |   |
| 2698 |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 2699 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |   |                                                     |   |       |   |   |   |   |
| 2700 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |   |                                                     |   |       |   |   |   |   |
| 2701 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |   |                                                     |   |       |   |   |   |   |
| 2702 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |   |                                                     |   |       |   |   |   |   |
| 2703 |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 2704 |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 2705 | <b>Result (eu4_chromium_roadway)</b>                                                                                                     |   |        |   |                                                     |   |       |   |   |   |   |
| 2706 |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 2707 | <b>General Statistics</b>                                                                                                                |   |        |   |                                                     |   |       |   |   |   |   |
| 2708 | Total Number of Observations                                                                                                             |   | 7      |   | Number of Distinct Observations                     |   | 5     |   |   |   |   |
| 2709 |                                                                                                                                          |   |        |   | Number of Missing Observations                      |   | 0     |   |   |   |   |
| 2710 | Minimum                                                                                                                                  |   | 2.6    |   | Mean                                                |   | 4.443 |   |   |   |   |
| 2711 | Maximum                                                                                                                                  |   | 9.6    |   | Median                                              |   | 2.8   |   |   |   |   |
| 2712 | SD                                                                                                                                       |   | 2.59   |   | Std. Error of Mean                                  |   | 0.979 |   |   |   |   |
| 2713 | Coefficient of Variation                                                                                                                 |   | 0.583  |   | Skewness                                            |   | 1.622 |   |   |   |   |
| 2714 |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 2715 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |   |        |   |                                                     |   |       |   |   |   |   |
| 2716 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |   |        |   |                                                     |   |       |   |   |   |   |
| 2717 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |   |        |   |                                                     |   |       |   |   |   |   |
| 2718 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |   |        |   |                                                     |   |       |   |   |   |   |
| 2719 |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 2720 | <b>Normal GOF Test</b>                                                                                                                   |   |        |   |                                                     |   |       |   |   |   |   |
| 2721 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.767  |   | <b>Shapiro Wilk GOF Test</b>                        |   |       |   |   |   |   |
| 2722 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.803  |   | Data Not Normal at 5% Significance Level            |   |       |   |   |   |   |
| 2723 | Lilliefors Test Statistic                                                                                                                |   | 0.309  |   | <b>Lilliefors GOF Test</b>                          |   |       |   |   |   |   |
| 2724 | 5% Lilliefors Critical Value                                                                                                             |   | 0.304  |   | Data Not Normal at 5% Significance Level            |   |       |   |   |   |   |
| 2725 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 2726 |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 2727 | <b>Assuming Normal Distribution</b>                                                                                                      |   |        |   |                                                     |   |       |   |   |   |   |
| 2728 | <b>95% Normal UCL</b>                                                                                                                    |   |        |   | <b>95% UCLs (Adjusted for Skewness)</b>             |   |       |   |   |   |   |
| 2729 | 95% Student's-t UCL                                                                                                                      |   | 6.345  |   | 95% Adjusted-CLT UCL (Chen-1995)                    |   | 6.694 |   |   |   |   |
| 2730 |                                                                                                                                          |   |        |   | 95% Modified-t UCL (Johnson-1978)                   |   | 6.445 |   |   |   |   |
| 2731 |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 2732 | <b>Gamma GOF Test</b>                                                                                                                    |   |        |   |                                                     |   |       |   |   |   |   |
| 2733 | A-D Test Statistic                                                                                                                       |   | 0.717  |   | <b>Anderson-Darling Gamma GOF Test</b>              |   |       |   |   |   |   |
| 2734 | 5% A-D Critical Value                                                                                                                    |   | 0.71   |   | Data Not Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |
| 2735 | K-S Test Statistic                                                                                                                       |   | 0.339  |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |       |   |   |   |   |
| 2736 | 5% K-S Critical Value                                                                                                                    |   | 0.313  |   | Data Not Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |
| 2737 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |        |   |                                                     |   |       |   |   |   |   |
| 2738 |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 2739 | <b>Gamma Statistics</b>                                                                                                                  |   |        |   |                                                     |   |       |   |   |   |   |
| 2740 | k hat (MLE)                                                                                                                              |   | 4.367  |   | k star (bias corrected MLE)                         |   | 2.591 |   |   |   |   |
| 2741 | Theta hat (MLE)                                                                                                                          |   | 1.017  |   | Theta star (bias corrected MLE)                     |   | 1.715 |   |   |   |   |
| 2742 | nu hat (MLE)                                                                                                                             |   | 61.13  |   | nu star (bias corrected)                            |   | 36.27 |   |   |   |   |
| 2743 | MLE Mean (bias corrected)                                                                                                                |   | 4.443  |   | MLE Sd (bias corrected)                             |   | 2.76  |   |   |   |   |
| 2744 |                                                                                                                                          |   |        |   | Approximate Chi Square Value (0.05)                 |   | 23.48 |   |   |   |   |
| 2745 | Adjusted Level of Significance                                                                                                           |   | 0.0158 |   | Adjusted Chi Square Value                           |   | 20.43 |   |   |   |   |
| 2746 |                                                                                                                                          |   |        |   |                                                     |   |       |   |   |   |   |
| 2747 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |        |   |                                                     |   |       |   |   |   |   |

| A    | B                                                                                                                                        | C | D     | E                               | F                                              | G | H     | I     | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|-------|---------------------------------|------------------------------------------------|---|-------|-------|---|---|---|
| 2748 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |       | 6.861                           | 95% Adjusted Gamma UCL (use when n<50)         |   |       | 7.885 |   |   |   |
| 2749 |                                                                                                                                          |   |       |                                 |                                                |   |       |       |   |   |   |
| 2750 | <b>Lognormal GOF Test</b>                                                                                                                |   |       |                                 |                                                |   |       |       |   |   |   |
| 2751 | Shapiro Wilk Test Statistic                                                                                                              |   |       | 0.819                           | <b>Shapiro Wilk Lognormal GOF Test</b>         |   |       |       |   |   |   |
| 2752 | 5% Shapiro Wilk Critical Value                                                                                                           |   |       | 0.803                           | Data appear Lognormal at 5% Significance Level |   |       |       |   |   |   |
| 2753 | Lilliefors Test Statistic                                                                                                                |   |       | 0.325                           | <b>Lilliefors Lognormal GOF Test</b>           |   |       |       |   |   |   |
| 2754 | 5% Lilliefors Critical Value                                                                                                             |   |       | 0.304                           | Data Not Lognormal at 5% Significance Level    |   |       |       |   |   |   |
| 2755 | <b>Data appear Approximate Lognormal at 5% Significance Level</b>                                                                        |   |       |                                 |                                                |   |       |       |   |   |   |
| 2756 |                                                                                                                                          |   |       |                                 |                                                |   |       |       |   |   |   |
| 2757 | <b>Lognormal Statistics</b>                                                                                                              |   |       |                                 |                                                |   |       |       |   |   |   |
| 2758 | Minimum of Logged Data                                                                                                                   |   |       | 0.956                           | Mean of logged Data                            |   |       | 1.372 |   |   |   |
| 2759 | Maximum of Logged Data                                                                                                                   |   |       | 2.262                           | SD of logged Data                              |   |       | 0.5   |   |   |   |
| 2760 |                                                                                                                                          |   |       |                                 |                                                |   |       |       |   |   |   |
| 2761 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |       |                                 |                                                |   |       |       |   |   |   |
| 2762 | 95% H-UCL                                                                                                                                |   | 7.4   | 90% Chebyshev (MVUE) UCL        |                                                |   | 6.887 |       |   |   |   |
| 2763 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 8.02  | 97.5% Chebyshev (MVUE) UCL      |                                                |   | 9.593 |       |   |   |   |
| 2764 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 12.68 |                                 |                                                |   |       |       |   |   |   |
| 2765 |                                                                                                                                          |   |       |                                 |                                                |   |       |       |   |   |   |
| 2766 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |       |                                 |                                                |   |       |       |   |   |   |
| 2767 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |       |                                 |                                                |   |       |       |   |   |   |
| 2768 |                                                                                                                                          |   |       |                                 |                                                |   |       |       |   |   |   |
| 2769 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |       |                                 |                                                |   |       |       |   |   |   |
| 2770 | 95% CLT UCL                                                                                                                              |   | 6.053 | 95% Jackknife UCL               |                                                |   | 6.345 |       |   |   |   |
| 2771 | 95% Standard Bootstrap UCL                                                                                                               |   | 5.982 | 95% Bootstrap-t UCL             |                                                |   | 9.692 |       |   |   |   |
| 2772 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 12.01 | 95% Percentile Bootstrap UCL    |                                                |   | 6.071 |       |   |   |   |
| 2773 | 95% BCA Bootstrap UCL                                                                                                                    |   | 6.386 |                                 |                                                |   |       |       |   |   |   |
| 2774 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 7.379 | 95% Chebyshev(Mean, Sd) UCL     |                                                |   | 8.709 |       |   |   |   |
| 2775 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 10.56 | 99% Chebyshev(Mean, Sd) UCL     |                                                |   | 14.18 |       |   |   |   |
| 2776 |                                                                                                                                          |   |       |                                 |                                                |   |       |       |   |   |   |
| 2777 | <b>Suggested UCL to Use</b>                                                                                                              |   |       |                                 |                                                |   |       |       |   |   |   |
| 2778 | 95% H-UCL                                                                                                                                |   | 7.4   |                                 |                                                |   |       |       |   |   |   |
| 2779 |                                                                                                                                          |   |       |                                 |                                                |   |       |       |   |   |   |
| 2780 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |       |                                 |                                                |   |       |       |   |   |   |
| 2781 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |       |                                 |                                                |   |       |       |   |   |   |
| 2782 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |       |                                 |                                                |   |       |       |   |   |   |
| 2783 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |       |                                 |                                                |   |       |       |   |   |   |
| 2784 |                                                                                                                                          |   |       |                                 |                                                |   |       |       |   |   |   |
| 2785 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |   |       |                                 |                                                |   |       |       |   |   |   |
| 2786 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |   |       |                                 |                                                |   |       |       |   |   |   |
| 2787 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |   |       |                                 |                                                |   |       |       |   |   |   |
| 2788 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |   |       |                                 |                                                |   |       |       |   |   |   |
| 2789 |                                                                                                                                          |   |       |                                 |                                                |   |       |       |   |   |   |
| 2790 |                                                                                                                                          |   |       |                                 |                                                |   |       |       |   |   |   |
| 2791 | <b>Result (eu4_cobalt_roadway)</b>                                                                                                       |   |       |                                 |                                                |   |       |       |   |   |   |
| 2792 |                                                                                                                                          |   |       |                                 |                                                |   |       |       |   |   |   |
| 2793 | <b>General Statistics</b>                                                                                                                |   |       |                                 |                                                |   |       |       |   |   |   |
| 2794 | Total Number of Observations                                                                                                             |   | 7     | Number of Distinct Observations |                                                |   | 7     |       |   |   |   |
| 2795 |                                                                                                                                          |   |       | Number of Missing Observations  |                                                |   | 0     |       |   |   |   |
| 2796 | Minimum                                                                                                                                  |   | 1.5   | Mean                            |                                                |   | 6.329 |       |   |   |   |
| 2797 | Maximum                                                                                                                                  |   | 24.7  | Median                          |                                                |   | 3.5   |       |   |   |   |
| 2798 | SD                                                                                                                                       |   | 8.234 | Std. Error of Mean              |                                                |   | 3.112 |       |   |   |   |
| 2799 | Coefficient of Variation                                                                                                                 |   | 1.301 | Skewness                        |                                                |   | 2.475 |       |   |   |   |
| 2800 |                                                                                                                                          |   |       |                                 |                                                |   |       |       |   |   |   |
| 2801 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |   |       |                                 |                                                |   |       |       |   |   |   |
| 2802 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |   |       |                                 |                                                |   |       |       |   |   |   |
| 2803 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |   |       |                                 |                                                |   |       |       |   |   |   |
| 2804 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |   |       |                                 |                                                |   |       |       |   |   |   |
| 2805 |                                                                                                                                          |   |       |                                 |                                                |   |       |       |   |   |   |
| 2806 | <b>Normal GOF Test</b>                                                                                                                   |   |       |                                 |                                                |   |       |       |   |   |   |
| 2807 | Shapiro Wilk Test Statistic                                                                                                              |   |       | 0.615                           | <b>Shapiro Wilk GOF Test</b>                   |   |       |       |   |   |   |
| 2808 | 5% Shapiro Wilk Critical Value                                                                                                           |   |       | 0.803                           | Data Not Normal at 5% Significance Level       |   |       |       |   |   |   |
| 2809 | Lilliefors Test Statistic                                                                                                                |   |       | 0.373                           | <b>Lilliefors GOF Test</b>                     |   |       |       |   |   |   |
| 2810 | 5% Lilliefors Critical Value                                                                                                             |   |       | 0.304                           | Data Not Normal at 5% Significance Level       |   |       |       |   |   |   |
| 2811 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |       |                                 |                                                |   |       |       |   |   |   |
| 2812 |                                                                                                                                          |   |       |                                 |                                                |   |       |       |   |   |   |
| 2813 | <b>Assuming Normal Distribution</b>                                                                                                      |   |       |                                 |                                                |   |       |       |   |   |   |
| 2814 | 95% Normal UCL                                                                                                                           |   |       |                                 | 95% UCLs (Adjusted for Skewness)               |   |       |       |   |   |   |

| A    | B | C | D                                                                                                                                        | E | F      | G | H | I | J | K                                                               | L     |
|------|---|---|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|---|---|---|---|-----------------------------------------------------------------|-------|
| 2815 |   |   | 95% Student's-t UCL                                                                                                                      |   | 12.38  |   |   |   |   | 95% Adjusted-CLT UCL (Chen-1995)                                | 14.56 |
| 2816 |   |   |                                                                                                                                          |   |        |   |   |   |   | 95% Modified-t UCL (Johnson-1978)                               | 12.86 |
| 2817 |   |   |                                                                                                                                          |   |        |   |   |   |   |                                                                 |       |
| 2818 |   |   | <b>Gamma GOF Test</b>                                                                                                                    |   |        |   |   |   |   |                                                                 |       |
| 2819 |   |   | A-D Test Statistic                                                                                                                       |   | 0.739  |   |   |   |   | <b>Anderson-Darling Gamma GOF Test</b>                          |       |
| 2820 |   |   | 5% A-D Critical Value                                                                                                                    |   | 0.725  |   |   |   |   | Data Not Gamma Distributed at 5% Significance Level             |       |
| 2821 |   |   | K-S Test Statistic                                                                                                                       |   | 0.305  |   |   |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |       |
| 2822 |   |   | 5% K-S Critical Value                                                                                                                    |   | 0.318  |   |   |   |   | Detected data appear Gamma Distributed at 5% Significance Level |       |
| 2823 |   |   | <b>Detected data follow Appr. Gamma Distribution at 5% Significance Level</b>                                                            |   |        |   |   |   |   |                                                                 |       |
| 2824 |   |   |                                                                                                                                          |   |        |   |   |   |   |                                                                 |       |
| 2825 |   |   | <b>Gamma Statistics</b>                                                                                                                  |   |        |   |   |   |   |                                                                 |       |
| 2826 |   |   | k hat (MLE)                                                                                                                              |   | 1.223  |   |   |   |   | k star (bias corrected MLE)                                     | 0.794 |
| 2827 |   |   | Theta hat (MLE)                                                                                                                          |   | 5.175  |   |   |   |   | Theta star (bias corrected MLE)                                 | 7.97  |
| 2828 |   |   | nu hat (MLE)                                                                                                                             |   | 17.12  |   |   |   |   | nu star (bias corrected)                                        | 11.12 |
| 2829 |   |   | MLE Mean (bias corrected)                                                                                                                |   | 6.329  |   |   |   |   | MLE Sd (bias corrected)                                         | 7.102 |
| 2830 |   |   |                                                                                                                                          |   |        |   |   |   |   | Approximate Chi Square Value (0.05)                             | 4.651 |
| 2831 |   |   | Adjusted Level of Significance                                                                                                           |   | 0.0158 |   |   |   |   | Adjusted Chi Square Value                                       | 3.474 |
| 2832 |   |   |                                                                                                                                          |   |        |   |   |   |   |                                                                 |       |
| 2833 |   |   | <b>Assuming Gamma Distribution</b>                                                                                                       |   |        |   |   |   |   |                                                                 |       |
| 2834 |   |   | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   | 15.13  |   |   |   |   | 95% Adjusted Gamma UCL (use when n<50)                          | 20.25 |
| 2835 |   |   |                                                                                                                                          |   |        |   |   |   |   |                                                                 |       |
| 2836 |   |   | <b>Lognormal GOF Test</b>                                                                                                                |   |        |   |   |   |   |                                                                 |       |
| 2837 |   |   | Shapiro Wilk Test Statistic                                                                                                              |   | 0.883  |   |   |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |       |
| 2838 |   |   | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.803  |   |   |   |   | Data appear Lognormal at 5% Significance Level                  |       |
| 2839 |   |   | Lilliefors Test Statistic                                                                                                                |   | 0.247  |   |   |   |   | <b>Lilliefors Lognormal GOF Test</b>                            |       |
| 2840 |   |   | 5% Lilliefors Critical Value                                                                                                             |   | 0.304  |   |   |   |   | Data appear Lognormal at 5% Significance Level                  |       |
| 2841 |   |   | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |        |   |   |   |   |                                                                 |       |
| 2842 |   |   |                                                                                                                                          |   |        |   |   |   |   |                                                                 |       |
| 2843 |   |   | <b>Lognormal Statistics</b>                                                                                                              |   |        |   |   |   |   |                                                                 |       |
| 2844 |   |   | Minimum of Logged Data                                                                                                                   |   | 0.405  |   |   |   |   | Mean of logged Data                                             | 1.383 |
| 2845 |   |   | Maximum of Logged Data                                                                                                                   |   | 3.207  |   |   |   |   | SD of logged Data                                               | 0.928 |
| 2846 |   |   |                                                                                                                                          |   |        |   |   |   |   |                                                                 |       |
| 2847 |   |   | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |        |   |   |   |   |                                                                 |       |
| 2848 |   |   | 95% H-UCL                                                                                                                                |   | 23.07  |   |   |   |   | 90% Chebyshev (MVUE) UCL                                        | 11.69 |
| 2849 |   |   | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 14.41  |   |   |   |   | 97.5% Chebyshev (MVUE) UCL                                      | 18.19 |
| 2850 |   |   | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 25.61  |   |   |   |   |                                                                 |       |
| 2851 |   |   |                                                                                                                                          |   |        |   |   |   |   |                                                                 |       |
| 2852 |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |        |   |   |   |   |                                                                 |       |
| 2853 |   |   | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |        |   |   |   |   |                                                                 |       |
| 2854 |   |   |                                                                                                                                          |   |        |   |   |   |   |                                                                 |       |
| 2855 |   |   | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |        |   |   |   |   |                                                                 |       |
| 2856 |   |   | 95% CLT UCL                                                                                                                              |   | 11.45  |   |   |   |   | 95% Jackknife UCL                                               | 12.38 |
| 2857 |   |   | 95% Standard Bootstrap UCL                                                                                                               |   | 11.08  |   |   |   |   | 95% Bootstrap-t UCL                                             | 38.67 |
| 2858 |   |   | 95% Hall's Bootstrap UCL                                                                                                                 |   | 38.75  |   |   |   |   | 95% Percentile Bootstrap UCL                                    | 12.33 |
| 2859 |   |   | 95% BCA Bootstrap UCL                                                                                                                    |   | 13.33  |   |   |   |   |                                                                 |       |
| 2860 |   |   | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 15.66  |   |   |   |   | 95% Chebyshev(Mean, Sd) UCL                                     | 19.89 |
| 2861 |   |   | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 25.76  |   |   |   |   | 99% Chebyshev(Mean, Sd) UCL                                     | 37.29 |
| 2862 |   |   |                                                                                                                                          |   |        |   |   |   |   |                                                                 |       |
| 2863 |   |   | <b>Suggested UCL to Use</b>                                                                                                              |   |        |   |   |   |   |                                                                 |       |
| 2864 |   |   | 95% Adjusted Gamma UCL                                                                                                                   |   | 20.25  |   |   |   |   |                                                                 |       |
| 2865 |   |   |                                                                                                                                          |   |        |   |   |   |   |                                                                 |       |
| 2866 |   |   | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                           |   |        |   |   |   |   |                                                                 |       |
| 2867 |   |   | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                   |   |        |   |   |   |   |                                                                 |       |
| 2868 |   |   |                                                                                                                                          |   |        |   |   |   |   |                                                                 |       |
| 2869 |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |   |   |   |   |                                                                 |       |
| 2870 |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |   |   |   |   |                                                                 |       |
| 2871 |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |   |   |   |   |                                                                 |       |
| 2872 |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |   |   |   |   |                                                                 |       |
| 2873 |   |   |                                                                                                                                          |   |        |   |   |   |   |                                                                 |       |
| 2874 |   |   |                                                                                                                                          |   |        |   |   |   |   |                                                                 |       |
| 2875 |   |   | <b>Result (eu4_iron_roadway)</b>                                                                                                         |   |        |   |   |   |   |                                                                 |       |
| 2876 |   |   |                                                                                                                                          |   |        |   |   |   |   |                                                                 |       |
| 2877 |   |   | <b>General Statistics</b>                                                                                                                |   |        |   |   |   |   |                                                                 |       |
| 2878 |   |   | Total Number of Observations                                                                                                             |   | 7      |   |   |   |   | Number of Distinct Observations                                 | 7     |
| 2879 |   |   |                                                                                                                                          |   |        |   |   |   |   | Number of Missing Observations                                  | 0     |
| 2880 |   |   | Minimum                                                                                                                                  |   | 13400  |   |   |   |   | Mean                                                            | 25900 |
| 2881 |   |   | Maximum                                                                                                                                  |   | 36100  |   |   |   |   | Median                                                          | 28700 |

| A    | B | C | D | E                                                                                                          | F      | G | H | I                                       | J                                                               | K     | L      |
|------|---|---|---|------------------------------------------------------------------------------------------------------------|--------|---|---|-----------------------------------------|-----------------------------------------------------------------|-------|--------|
| 2882 |   |   |   | SD                                                                                                         | 7398   |   |   |                                         | Std. Error of Mean                                              |       | 2796   |
| 2883 |   |   |   | Coefficient of Variation                                                                                   | 0.286  |   |   |                                         | Skewness                                                        |       | -0.519 |
| 2884 |   |   |   |                                                                                                            |        |   |   |                                         |                                                                 |       |        |
| 2885 |   |   |   | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b> |        |   |   |                                         |                                                                 |       |        |
| 2886 |   |   |   | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>     |        |   |   |                                         |                                                                 |       |        |
| 2887 |   |   |   | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                        |        |   |   |                                         |                                                                 |       |        |
| 2888 |   |   |   | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>             |        |   |   |                                         |                                                                 |       |        |
| 2889 |   |   |   |                                                                                                            |        |   |   |                                         |                                                                 |       |        |
| 2890 |   |   |   | <b>Normal GOF Test</b>                                                                                     |        |   |   |                                         |                                                                 |       |        |
| 2891 |   |   |   | Shapiro Wilk Test Statistic                                                                                | 0.959  |   |   |                                         | <b>Shapiro Wilk GOF Test</b>                                    |       |        |
| 2892 |   |   |   | 5% Shapiro Wilk Critical Value                                                                             | 0.803  |   |   |                                         | Data appear Normal at 5% Significance Level                     |       |        |
| 2893 |   |   |   | Lilliefors Test Statistic                                                                                  | 0.219  |   |   |                                         | <b>Lilliefors GOF Test</b>                                      |       |        |
| 2894 |   |   |   | 5% Lilliefors Critical Value                                                                               | 0.304  |   |   |                                         | Data appear Normal at 5% Significance Level                     |       |        |
| 2895 |   |   |   | <b>Data appear Normal at 5% Significance Level</b>                                                         |        |   |   |                                         |                                                                 |       |        |
| 2896 |   |   |   |                                                                                                            |        |   |   |                                         |                                                                 |       |        |
| 2897 |   |   |   | <b>Assuming Normal Distribution</b>                                                                        |        |   |   |                                         |                                                                 |       |        |
| 2898 |   |   |   | <b>95% Normal UCL</b>                                                                                      |        |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |                                                                 |       |        |
| 2899 |   |   |   | 95% Student's-t UCL                                                                                        | 31333  |   |   |                                         | 95% Adjusted-CLT UCL (Chen-1995)                                | 29913 |        |
| 2900 |   |   |   |                                                                                                            |        |   |   |                                         | 95% Modified-t UCL (Johnson-1978)                               | 31242 |        |
| 2901 |   |   |   |                                                                                                            |        |   |   |                                         |                                                                 |       |        |
| 2902 |   |   |   | <b>Gamma GOF Test</b>                                                                                      |        |   |   |                                         |                                                                 |       |        |
| 2903 |   |   |   | A-D Test Statistic                                                                                         | 0.353  |   |   |                                         | <b>Anderson-Darling Gamma GOF Test</b>                          |       |        |
| 2904 |   |   |   | 5% A-D Critical Value                                                                                      | 0.708  |   |   |                                         | Detected data appear Gamma Distributed at 5% Significance Level |       |        |
| 2905 |   |   |   | K-S Test Statistic                                                                                         | 0.249  |   |   |                                         | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |       |        |
| 2906 |   |   |   | 5% K-S Critical Value                                                                                      | 0.312  |   |   |                                         | Detected data appear Gamma Distributed at 5% Significance Level |       |        |
| 2907 |   |   |   | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                     |        |   |   |                                         |                                                                 |       |        |
| 2908 |   |   |   |                                                                                                            |        |   |   |                                         |                                                                 |       |        |
| 2909 |   |   |   | <b>Gamma Statistics</b>                                                                                    |        |   |   |                                         |                                                                 |       |        |
| 2910 |   |   |   | k hat (MLE)                                                                                                | 12.25  |   |   |                                         | k star (bias corrected MLE)                                     | 7.095 |        |
| 2911 |   |   |   | Theta hat (MLE)                                                                                            | 2114   |   |   |                                         | Theta star (bias corrected MLE)                                 | 3651  |        |
| 2912 |   |   |   | nu hat (MLE)                                                                                               | 171.5  |   |   |                                         | nu star (bias corrected)                                        | 99.32 |        |
| 2913 |   |   |   | MLE Mean (bias corrected)                                                                                  | 25900  |   |   |                                         | MLE Sd (bias corrected)                                         | 9724  |        |
| 2914 |   |   |   |                                                                                                            |        |   |   |                                         | Approximate Chi Square Value (0.05)                             | 77.33 |        |
| 2915 |   |   |   | Adjusted Level of Significance                                                                             | 0.0158 |   |   |                                         | Adjusted Chi Square Value                                       | 71.49 |        |
| 2916 |   |   |   |                                                                                                            |        |   |   |                                         |                                                                 |       |        |
| 2917 |   |   |   | <b>Assuming Gamma Distribution</b>                                                                         |        |   |   |                                         |                                                                 |       |        |
| 2918 |   |   |   | 95% Approximate Gamma UCL (use when n>=50))                                                                | 33265  |   |   |                                         | 95% Adjusted Gamma UCL (use when n<50)                          | 35984 |        |
| 2919 |   |   |   |                                                                                                            |        |   |   |                                         |                                                                 |       |        |
| 2920 |   |   |   | <b>Lognormal GOF Test</b>                                                                                  |        |   |   |                                         |                                                                 |       |        |
| 2921 |   |   |   | Shapiro Wilk Test Statistic                                                                                | 0.904  |   |   |                                         | <b>Shapiro Wilk Lognormal GOF Test</b>                          |       |        |
| 2922 |   |   |   | 5% Shapiro Wilk Critical Value                                                                             | 0.803  |   |   |                                         | Data appear Lognormal at 5% Significance Level                  |       |        |
| 2923 |   |   |   | Lilliefors Test Statistic                                                                                  | 0.242  |   |   |                                         | <b>Lilliefors Lognormal GOF Test</b>                            |       |        |
| 2924 |   |   |   | 5% Lilliefors Critical Value                                                                               | 0.304  |   |   |                                         | Data appear Lognormal at 5% Significance Level                  |       |        |
| 2925 |   |   |   | <b>Data appear Lognormal at 5% Significance Level</b>                                                      |        |   |   |                                         |                                                                 |       |        |
| 2926 |   |   |   |                                                                                                            |        |   |   |                                         |                                                                 |       |        |
| 2927 |   |   |   | <b>Lognormal Statistics</b>                                                                                |        |   |   |                                         |                                                                 |       |        |
| 2928 |   |   |   | Minimum of Logged Data                                                                                     | 9.503  |   |   |                                         | Mean of logged Data                                             | 10.12 |        |
| 2929 |   |   |   | Maximum of Logged Data                                                                                     | 10.49  |   |   |                                         | SD of logged Data                                               | 0.326 |        |
| 2930 |   |   |   |                                                                                                            |        |   |   |                                         |                                                                 |       |        |
| 2931 |   |   |   | <b>Assuming Lognormal Distribution</b>                                                                     |        |   |   |                                         |                                                                 |       |        |
| 2932 |   |   |   | 95% H-UCL                                                                                                  | 35332  |   |   |                                         | 90% Chebyshev (MVUE) UCL                                        | 35628 |        |
| 2933 |   |   |   | 95% Chebyshev (MVUE) UCL                                                                                   | 39989  |   |   |                                         | 97.5% Chebyshev (MVUE) UCL                                      | 46042 |        |
| 2934 |   |   |   | 99% Chebyshev (MVUE) UCL                                                                                   | 57932  |   |   |                                         |                                                                 |       |        |
| 2935 |   |   |   |                                                                                                            |        |   |   |                                         |                                                                 |       |        |
| 2936 |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                      |        |   |   |                                         |                                                                 |       |        |
| 2937 |   |   |   | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                           |        |   |   |                                         |                                                                 |       |        |
| 2938 |   |   |   |                                                                                                            |        |   |   |                                         |                                                                 |       |        |
| 2939 |   |   |   | <b>Nonparametric Distribution Free UCLs</b>                                                                |        |   |   |                                         |                                                                 |       |        |
| 2940 |   |   |   | 95% CLT UCL                                                                                                | 30499  |   |   |                                         | 95% Jackknife UCL                                               | 31333 |        |
| 2941 |   |   |   | 95% Standard Bootstrap UCL                                                                                 | 30175  |   |   |                                         | 95% Bootstrap-t UCL                                             | 30503 |        |
| 2942 |   |   |   | 95% Hall's Bootstrap UCL                                                                                   | 30283  |   |   |                                         | 95% Percentile Bootstrap UCL                                    | 30214 |        |
| 2943 |   |   |   | 95% BCA Bootstrap UCL                                                                                      | 29743  |   |   |                                         |                                                                 |       |        |
| 2944 |   |   |   | 90% Chebyshev (Mean, Sd) UCL                                                                               | 34288  |   |   |                                         | 95% Chebyshev (Mean, Sd) UCL                                    | 38087 |        |
| 2945 |   |   |   | 97.5% Chebyshev (Mean, Sd) UCL                                                                             | 43361  |   |   |                                         | 99% Chebyshev (Mean, Sd) UCL                                    | 53720 |        |
| 2946 |   |   |   |                                                                                                            |        |   |   |                                         |                                                                 |       |        |
| 2947 |   |   |   | <b>Suggested UCL to Use</b>                                                                                |        |   |   |                                         |                                                                 |       |        |
| 2948 |   |   |   | 95% Student's-t UCL                                                                                        | 31333  |   |   |                                         |                                                                 |       |        |

| A    | B                                                                                                                                      | C      | D | E | F | G                                       | H | I                                                   | J     | K | L |
|------|----------------------------------------------------------------------------------------------------------------------------------------|--------|---|---|---|-----------------------------------------|---|-----------------------------------------------------|-------|---|---|
| 2949 |                                                                                                                                        |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2950 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.           |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2951 | Recommendations are based upon data size, data distribution, and skewness.                                                             |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2952 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).               |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2953 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistica |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2954 |                                                                                                                                        |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2955 | <b>Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be</b>               |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2956 | <b>reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.</b>                                     |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2957 |                                                                                                                                        |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2958 |                                                                                                                                        |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2959 | <b>Result (eu4_lead_roadway)</b>                                                                                                       |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2960 |                                                                                                                                        |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2961 | <b>General Statistics</b>                                                                                                              |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2962 | Total Number of Observations                                                                                                           | 7      |   |   |   |                                         |   | Number of Distinct Observations                     | 7     |   |   |
| 2963 |                                                                                                                                        |        |   |   |   |                                         |   | Number of Missing Observations                      | 0     |   |   |
| 2964 | Minimum                                                                                                                                | 13.7   |   |   |   |                                         |   | Mean                                                | 440.4 |   |   |
| 2965 | Maximum                                                                                                                                | 2770   |   |   |   |                                         |   | Median                                              | 76.5  |   |   |
| 2966 | SD                                                                                                                                     | 1028   |   |   |   |                                         |   | Std. Error of Mean                                  | 388.4 |   |   |
| 2967 | Coefficient of Variation                                                                                                               | 2.333  |   |   |   |                                         |   | Skewness                                            | 2.641 |   |   |
| 2968 |                                                                                                                                        |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2969 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                             |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2970 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                 |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2971 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                    |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2972 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                         |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2973 |                                                                                                                                        |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2974 | <b>Normal GOF Test</b>                                                                                                                 |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2975 | Shapiro Wilk Test Statistic                                                                                                            | 0.48   |   |   |   |                                         |   | <b>Shapiro Wilk GOF Test</b>                        |       |   |   |
| 2976 | 5% Shapiro Wilk Critical Value                                                                                                         | 0.803  |   |   |   |                                         |   | Data Not Normal at 5% Significance Level            |       |   |   |
| 2977 | Lilliefors Test Statistic                                                                                                              | 0.493  |   |   |   |                                         |   | <b>Lilliefors GOF Test</b>                          |       |   |   |
| 2978 | 5% Lilliefors Critical Value                                                                                                           | 0.304  |   |   |   |                                         |   | Data Not Normal at 5% Significance Level            |       |   |   |
| 2979 | <b>Data Not Normal at 5% Significance Level</b>                                                                                        |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2980 |                                                                                                                                        |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2981 | <b>Assuming Normal Distribution</b>                                                                                                    |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2982 | <b>95% Normal UCL</b>                                                                                                                  |        |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |                                                     |       |   |   |
| 2983 | 95% Student's-t UCL                                                                                                                    | 1195   |   |   |   |                                         |   | 95% Adjusted-CLT UCL (Chen-1995)                    | 1494  |   |   |
| 2984 |                                                                                                                                        |        |   |   |   |                                         |   | 95% Modified-t UCL (Johnson-1978)                   | 1260  |   |   |
| 2985 |                                                                                                                                        |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2986 | <b>Gamma GOF Test</b>                                                                                                                  |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2987 | A-D Test Statistic                                                                                                                     | 1.206  |   |   |   |                                         |   | <b>Anderson-Darling Gamma GOF Test</b>              |       |   |   |
| 2988 | 5% A-D Critical Value                                                                                                                  | 0.772  |   |   |   |                                         |   | Data Not Gamma Distributed at 5% Significance Level |       |   |   |
| 2989 | K-S Test Statistic                                                                                                                     | 0.448  |   |   |   |                                         |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |       |   |   |
| 2990 | 5% K-S Critical Value                                                                                                                  | 0.332  |   |   |   |                                         |   | Data Not Gamma Distributed at 5% Significance Level |       |   |   |
| 2991 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                             |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2992 |                                                                                                                                        |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2993 | <b>Gamma Statistics</b>                                                                                                                |        |   |   |   |                                         |   |                                                     |       |   |   |
| 2994 | k hat (MLE)                                                                                                                            | 0.375  |   |   |   |                                         |   | k star (bias corrected MLE)                         | 0.309 |   |   |
| 2995 | Theta hat (MLE)                                                                                                                        | 1175   |   |   |   |                                         |   | Theta star (bias corrected MLE)                     | 1423  |   |   |
| 2996 | nu hat (MLE)                                                                                                                           | 5.249  |   |   |   |                                         |   | nu star (bias corrected)                            | 4.332 |   |   |
| 2997 | MLE Mean (bias corrected)                                                                                                              | 440.4  |   |   |   |                                         |   | MLE Sd (bias corrected)                             | 791.7 |   |   |
| 2998 |                                                                                                                                        |        |   |   |   |                                         |   | Approximate Chi Square Value (0.05)                 | 0.857 |   |   |
| 2999 | Adjusted Level of Significance                                                                                                         | 0.0158 |   |   |   |                                         |   | Adjusted Chi Square Value                           | 0.488 |   |   |
| 3000 |                                                                                                                                        |        |   |   |   |                                         |   |                                                     |       |   |   |
| 3001 | <b>Assuming Gamma Distribution</b>                                                                                                     |        |   |   |   |                                         |   |                                                     |       |   |   |
| 3002 | 95% Approximate Gamma UCL (use when n>=50)                                                                                             | 2226   |   |   |   |                                         |   | 95% Adjusted Gamma UCL (use when n<50)              | 3909  |   |   |
| 3003 |                                                                                                                                        |        |   |   |   |                                         |   |                                                     |       |   |   |
| 3004 | <b>Lognormal GOF Test</b>                                                                                                              |        |   |   |   |                                         |   |                                                     |       |   |   |
| 3005 | Shapiro Wilk Test Statistic                                                                                                            | 0.814  |   |   |   |                                         |   | <b>Shapiro Wilk Lognormal GOF Test</b>              |       |   |   |
| 3006 | 5% Shapiro Wilk Critical Value                                                                                                         | 0.803  |   |   |   |                                         |   | Data appear Lognormal at 5% Significance Level      |       |   |   |
| 3007 | Lilliefors Test Statistic                                                                                                              | 0.333  |   |   |   |                                         |   | <b>Lilliefors Lognormal GOF Test</b>                |       |   |   |
| 3008 | 5% Lilliefors Critical Value                                                                                                           | 0.304  |   |   |   |                                         |   | Data Not Lognormal at 5% Significance Level         |       |   |   |
| 3009 | <b>Data appear Approximate Lognormal at 5% Significance Level</b>                                                                      |        |   |   |   |                                         |   |                                                     |       |   |   |
| 3010 |                                                                                                                                        |        |   |   |   |                                         |   |                                                     |       |   |   |
| 3011 | <b>Lognormal Statistics</b>                                                                                                            |        |   |   |   |                                         |   |                                                     |       |   |   |
| 3012 | Minimum of Logged Data                                                                                                                 | 2.617  |   |   |   |                                         |   | Mean of logged Data                                 | 4.314 |   |   |
| 3013 | Maximum of Logged Data                                                                                                                 | 7.927  |   |   |   |                                         |   | SD of logged Data                                   | 1.768 |   |   |
| 3014 |                                                                                                                                        |        |   |   |   |                                         |   |                                                     |       |   |   |
| 3015 | <b>Assuming Lognormal Distribution</b>                                                                                                 |        |   |   |   |                                         |   |                                                     |       |   |   |

| A    | B | C | D | E                                                                                                                                        | F      | G | H | I                                       | J | K                                                   | L     |
|------|---|---|---|------------------------------------------------------------------------------------------------------------------------------------------|--------|---|---|-----------------------------------------|---|-----------------------------------------------------|-------|
| 3016 |   |   |   | 95% H-UCL                                                                                                                                | 27420  |   |   |                                         |   | 90% Chebyshev (MVUE) UCL                            | 700.1 |
| 3017 |   |   |   | 95% Chebyshev (MVUE) UCL                                                                                                                 | 908.1  |   |   |                                         |   | 97.5% Chebyshev (MVUE) UCL                          | 1197  |
| 3018 |   |   |   | 99% Chebyshev (MVUE) UCL                                                                                                                 | 1763   |   |   |                                         |   |                                                     |       |
| 3019 |   |   |   |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |
| 3020 |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |   |   |                                         |   |                                                     |       |
| 3021 |   |   |   | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |        |   |   |                                         |   |                                                     |       |
| 3022 |   |   |   |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |
| 3023 |   |   |   | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |        |   |   |                                         |   |                                                     |       |
| 3024 |   |   |   | 95% CLT UCL                                                                                                                              | 1079   |   |   |                                         |   | 95% Jackknife UCL                                   | 1195  |
| 3025 |   |   |   | 95% Standard Bootstrap UCL                                                                                                               | 1013   |   |   |                                         |   | 95% Bootstrap-t UCL                                 | 16231 |
| 3026 |   |   |   | 95% Hall's Bootstrap UCL                                                                                                                 | 13510  |   |   |                                         |   | 95% Percentile Bootstrap UCL                        | 1213  |
| 3027 |   |   |   | 95% BCA Bootstrap UCL                                                                                                                    | 1598   |   |   |                                         |   |                                                     |       |
| 3028 |   |   |   | 90% Chebyshev(Mean, Sd) UCL                                                                                                              | 1606   |   |   |                                         |   | 95% Chebyshev(Mean, Sd) UCL                         | 2134  |
| 3029 |   |   |   | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            | 2866   |   |   |                                         |   | 99% Chebyshev(Mean, Sd) UCL                         | 4305  |
| 3030 |   |   |   |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |
| 3031 |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |        |   |   |                                         |   |                                                     |       |
| 3032 |   |   |   | 99% Chebyshev (Mean, Sd) UCL                                                                                                             | 4305   |   |   |                                         |   |                                                     |       |
| 3033 |   |   |   |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |
| 3034 |   |   |   | <b>Recommended UCL exceeds the maximum observation</b>                                                                                   |        |   |   |                                         |   |                                                     |       |
| 3035 |   |   |   |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |
| 3036 |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |   |   |                                         |   |                                                     |       |
| 3037 |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |   |   |                                         |   |                                                     |       |
| 3038 |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |   |   |                                         |   |                                                     |       |
| 3039 |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |   |   |                                         |   |                                                     |       |
| 3040 |   |   |   |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |
| 3041 |   |   |   |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |
| 3042 |   |   |   | <b>Result (eu4_manganese_roadway)</b>                                                                                                    |        |   |   |                                         |   |                                                     |       |
| 3043 |   |   |   |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |
| 3044 |   |   |   | <b>General Statistics</b>                                                                                                                |        |   |   |                                         |   |                                                     |       |
| 3045 |   |   |   | Total Number of Observations                                                                                                             | 7      |   |   |                                         |   | Number of Distinct Observations                     | 7     |
| 3046 |   |   |   |                                                                                                                                          |        |   |   |                                         |   | Number of Missing Observations                      | 0     |
| 3047 |   |   |   | Minimum                                                                                                                                  | 182    |   |   |                                         |   | Mean                                                | 2165  |
| 3048 |   |   |   | Maximum                                                                                                                                  | 12800  |   |   |                                         |   | Median                                              | 454   |
| 3049 |   |   |   | SD                                                                                                                                       | 4692   |   |   |                                         |   | Std. Error of Mean                                  | 1773  |
| 3050 |   |   |   | Coefficient of Variation                                                                                                                 | 2.167  |   |   |                                         |   | Skewness                                            | 2.641 |
| 3051 |   |   |   |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |
| 3052 |   |   |   | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |        |   |   |                                         |   |                                                     |       |
| 3053 |   |   |   | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |        |   |   |                                         |   |                                                     |       |
| 3054 |   |   |   | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012),</b>                                                      |        |   |   |                                         |   |                                                     |       |
| 3055 |   |   |   | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |        |   |   |                                         |   |                                                     |       |
| 3056 |   |   |   |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |
| 3057 |   |   |   | <b>Normal GOF Test</b>                                                                                                                   |        |   |   |                                         |   |                                                     |       |
| 3058 |   |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.482  |   |   |                                         |   | <b>Shapiro Wilk GOF Test</b>                        |       |
| 3059 |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                           | 0.803  |   |   |                                         |   | Data Not Normal at 5% Significance Level            |       |
| 3060 |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.487  |   |   |                                         |   | <b>Lilliefors GOF Test</b>                          |       |
| 3061 |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.304  |   |   |                                         |   | Data Not Normal at 5% Significance Level            |       |
| 3062 |   |   |   | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |        |   |   |                                         |   |                                                     |       |
| 3063 |   |   |   |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |
| 3064 |   |   |   | <b>Assuming Normal Distribution</b>                                                                                                      |        |   |   |                                         |   |                                                     |       |
| 3065 |   |   |   | <b>95% Normal UCL</b>                                                                                                                    |        |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |                                                     |       |
| 3066 |   |   |   | 95% Student's-t UCL                                                                                                                      | 5611   |   |   |                                         |   | 95% Adjusted-CLT UCL (Chen-1995)                    | 6973  |
| 3067 |   |   |   |                                                                                                                                          |        |   |   |                                         |   | 95% Modified-t UCL (Johnson-1978)                   | 5906  |
| 3068 |   |   |   |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |
| 3069 |   |   |   | <b>Gamma GOF Test</b>                                                                                                                    |        |   |   |                                         |   |                                                     |       |
| 3070 |   |   |   | A-D Test Statistic                                                                                                                       | 1.458  |   |   |                                         |   | <b>Anderson-Darling Gamma GOF Test</b>              |       |
| 3071 |   |   |   | 5% A-D Critical Value                                                                                                                    | 0.752  |   |   |                                         |   | Data Not Gamma Distributed at 5% Significance Level |       |
| 3072 |   |   |   | K-S Test Statistic                                                                                                                       | 0.452  |   |   |                                         |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |       |
| 3073 |   |   |   | 5% K-S Critical Value                                                                                                                    | 0.327  |   |   |                                         |   | Data Not Gamma Distributed at 5% Significance Level |       |
| 3074 |   |   |   | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |        |   |   |                                         |   |                                                     |       |
| 3075 |   |   |   |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |
| 3076 |   |   |   | <b>Gamma Statistics</b>                                                                                                                  |        |   |   |                                         |   |                                                     |       |
| 3077 |   |   |   | k hat (MLE)                                                                                                                              | 0.5    |   |   |                                         |   | k star (bias corrected MLE)                         | 0.381 |
| 3078 |   |   |   | Theta hat (MLE)                                                                                                                          | 4328   |   |   |                                         |   | Theta star (bias corrected MLE)                     | 5681  |
| 3079 |   |   |   | nu hat (MLE)                                                                                                                             | 7.005  |   |   |                                         |   | nu star (bias corrected)                            | 5.336 |
| 3080 |   |   |   | MLE Mean (bias corrected)                                                                                                                | 2165   |   |   |                                         |   | MLE Sd (bias corrected)                             | 3507  |
| 3081 |   |   |   |                                                                                                                                          |        |   |   |                                         |   | Approximate Chi Square Value (0.05)                 | 1.31  |
| 3082 |   |   |   | Adjusted Level of Significance                                                                                                           | 0.0158 |   |   |                                         |   | Adjusted Chi Square Value                           | 0.804 |

|      | A                                                                                                                                                                                                          | B | C | D | E       | F                                                    | G | H | I | J      | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---------|------------------------------------------------------|---|---|---|--------|---|---|--|
| 3083 |                                                                                                                                                                                                            |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3084 | <b>Assuming Gamma Distribution</b>                                                                                                                                                                         |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3085 | 95% Approximate Gamma UCL (use when n>=50)                                                                                                                                                                 |   |   |   | 8816    | 95% Adjusted Gamma UCL (use when n<50)               |   |   |   | 14368  |   |   |  |
| 3086 |                                                                                                                                                                                                            |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3087 | <b>Lognormal GOF Test</b>                                                                                                                                                                                  |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3088 | Shapiro Wilk Test Statistic                                                                                                                                                                                |   |   |   | 0.724   | <b>Shapiro Wilk Lognormal GOF Test</b>               |   |   |   |        |   |   |  |
| 3089 | 5% Shapiro Wilk Critical Value                                                                                                                                                                             |   |   |   | 0.803   | Data Not Lognormal at 5% Significance Level          |   |   |   |        |   |   |  |
| 3090 | Lilliefors Test Statistic                                                                                                                                                                                  |   |   |   | 0.355   | <b>Lilliefors Lognormal GOF Test</b>                 |   |   |   |        |   |   |  |
| 3091 | 5% Lilliefors Critical Value                                                                                                                                                                               |   |   |   | 0.304   | Data Not Lognormal at 5% Significance Level          |   |   |   |        |   |   |  |
| 3092 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                                                                                         |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3093 |                                                                                                                                                                                                            |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3094 | <b>Lognormal Statistics</b>                                                                                                                                                                                |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3095 | Minimum of Logged Data                                                                                                                                                                                     |   |   |   | 5.204   | Mean of logged Data                                  |   |   |   | 6.411  |   |   |  |
| 3096 | Maximum of Logged Data                                                                                                                                                                                     |   |   |   | 9.457   | SD of logged Data                                    |   |   |   | 1.399  |   |   |  |
| 3097 |                                                                                                                                                                                                            |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3098 | <b>Assuming Lognormal Distribution</b>                                                                                                                                                                     |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3099 | 95% H-UCL                                                                                                                                                                                                  |   |   |   | 26145   | 90% Chebyshev (MVUE) UCL                             |   |   |   | 3352   |   |   |  |
| 3100 | 95% Chebyshev (MVUE) UCL                                                                                                                                                                                   |   |   |   | 4277    | 97.5% Chebyshev (MVUE) UCL                           |   |   |   | 5562   |   |   |  |
| 3101 | 99% Chebyshev (MVUE) UCL                                                                                                                                                                                   |   |   |   | 8085    |                                                      |   |   |   |        |   |   |  |
| 3102 |                                                                                                                                                                                                            |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3103 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                                                                                      |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3104 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                                                                                                |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3105 |                                                                                                                                                                                                            |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3106 | <b>Nonparametric Distribution Free UCLs</b>                                                                                                                                                                |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3107 | 95% CLT UCL                                                                                                                                                                                                |   |   |   | 5082    | 95% Jackknife UCL                                    |   |   |   | 5611   |   |   |  |
| 3108 | 95% Standard Bootstrap UCL                                                                                                                                                                                 |   |   |   | 4855    | 95% Bootstrap-t UCL                                  |   |   |   | 82506  |   |   |  |
| 3109 | 95% Hall's Bootstrap UCL                                                                                                                                                                                   |   |   |   | 45630   | 95% Percentile Bootstrap UCL                         |   |   |   | 5690   |   |   |  |
| 3110 | 95% BCA Bootstrap UCL                                                                                                                                                                                      |   |   |   | 7454    |                                                      |   |   |   |        |   |   |  |
| 3111 | 90% Chebyshev(Mean, Sd) UCL                                                                                                                                                                                |   |   |   | 7485    | 95% Chebyshev(Mean, Sd) UCL                          |   |   |   | 9895   |   |   |  |
| 3112 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                                                                                              |   |   |   | 13239   | 99% Chebyshev(Mean, Sd) UCL                          |   |   |   | 19809  |   |   |  |
| 3113 |                                                                                                                                                                                                            |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3114 | <b>Suggested UCL to Use</b>                                                                                                                                                                                |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3115 | 95% Hall's Bootstrap UCL                                                                                                                                                                                   |   |   |   | 45630   |                                                      |   |   |   |        |   |   |  |
| 3116 |                                                                                                                                                                                                            |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3117 | <b>Recommended UCL exceeds the maximum observation</b>                                                                                                                                                     |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3118 |                                                                                                                                                                                                            |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3119 | <b>Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL</b>                                                                          |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3120 |                                                                                                                                                                                                            |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3121 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.                                                                               |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3122 | Recommendations are based upon data size, data distribution, and skewness.                                                                                                                                 |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3123 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                                                                                   |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3124 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.                                                                  |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3125 |                                                                                                                                                                                                            |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3126 | <b>Result (eu4_thallium_roadway)</b>                                                                                                                                                                       |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3127 |                                                                                                                                                                                                            |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3128 | <b>General Statistics</b>                                                                                                                                                                                  |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3129 | Total Number of Observations                                                                                                                                                                               |   |   |   | 6       | Number of Distinct Observations                      |   |   |   | 6      |   |   |  |
| 3130 | Number of Detects                                                                                                                                                                                          |   |   |   | 5       | Number of Non-Detects                                |   |   |   | 1      |   |   |  |
| 3131 | Number of Distinct Detects                                                                                                                                                                                 |   |   |   | 5       | Number of Distinct Non-Detects                       |   |   |   | 1      |   |   |  |
| 3132 | Minimum Detect                                                                                                                                                                                             |   |   |   | 0.044   | Minimum Non-Detect                                   |   |   |   | 0.038  |   |   |  |
| 3133 | Maximum Detect                                                                                                                                                                                             |   |   |   | 0.13    | Maximum Non-Detect                                   |   |   |   | 0.038  |   |   |  |
| 3134 | Variance Detects                                                                                                                                                                                           |   |   |   | 0.00154 | Percent Non-Detects                                  |   |   |   | 16.67% |   |   |  |
| 3135 | Mean Detects                                                                                                                                                                                               |   |   |   | 0.0844  | SD Detects                                           |   |   |   | 0.0392 |   |   |  |
| 3136 | Median Detects                                                                                                                                                                                             |   |   |   | 0.077   | CV Detects                                           |   |   |   | 0.465  |   |   |  |
| 3137 | Skewness Detects                                                                                                                                                                                           |   |   |   | 0.251   | Kurtosis Detects                                     |   |   |   | -2.795 |   |   |  |
| 3138 | Mean of Logged Detects                                                                                                                                                                                     |   |   |   | -2.565  | SD of Logged Detects                                 |   |   |   | 0.488  |   |   |  |
| 3139 |                                                                                                                                                                                                            |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3140 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b> |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3141 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                                                                                        |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3142 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                                                                                             |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3143 |                                                                                                                                                                                                            |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3144 |                                                                                                                                                                                                            |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3145 | <b>Normal GOF Test on Detects Only</b>                                                                                                                                                                     |   |   |   |         |                                                      |   |   |   |        |   |   |  |
| 3146 | Shapiro Wilk Test Statistic                                                                                                                                                                                |   |   |   | 0.886   | <b>Shapiro Wilk GOF Test</b>                         |   |   |   |        |   |   |  |
| 3147 | 5% Shapiro Wilk Critical Value                                                                                                                                                                             |   |   |   | 0.762   | Detected Data appear Normal at 5% Significance Level |   |   |   |        |   |   |  |
| 3148 | Lilliefors Test Statistic                                                                                                                                                                                  |   |   |   | 0.218   | <b>Lilliefors GOF Test</b>                           |   |   |   |        |   |   |  |
| 3149 | 5% Lilliefors Critical Value                                                                                                                                                                               |   |   |   | 0.343   | Detected Data appear Normal at 5% Significance Level |   |   |   |        |   |   |  |

|      | A                                                                                                                         | B       | C                                                             | D | E      | F | G | H | I | J | K | L |
|------|---------------------------------------------------------------------------------------------------------------------------|---------|---------------------------------------------------------------|---|--------|---|---|---|---|---|---|---|
| 3150 | <b>Detected Data appear Normal at 5% Significance Level</b>                                                               |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3151 |                                                                                                                           |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3152 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3153 | KM Mean                                                                                                                   | 0.0767  | KM Standard Error of Mean                                     |   | 0.0166 |   |   |   |   |   |   |   |
| 3154 | KM SD                                                                                                                     | 0.0364  | 95% KM (BCA) UCL                                              |   | 0.0987 |   |   |   |   |   |   |   |
| 3155 | 95% KM (t) UCL                                                                                                            | 0.11    | 95% KM (Percentile Bootstrap) UCL                             |   | 0.101  |   |   |   |   |   |   |   |
| 3156 | 95% KM (z) UCL                                                                                                            | 0.104   | 95% KM Bootstrap t UCL                                        |   | 0.125  |   |   |   |   |   |   |   |
| 3157 | 90% KM Chebyshev UCL                                                                                                      | 0.126   | 95% KM Chebyshev UCL                                          |   | 0.149  |   |   |   |   |   |   |   |
| 3158 | 97.5% KM Chebyshev UCL                                                                                                    | 0.18    | 99% KM Chebyshev UCL                                          |   | 0.242  |   |   |   |   |   |   |   |
| 3159 |                                                                                                                           |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3160 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3161 | A-D Test Statistic                                                                                                        | 0.369   | <b>Anderson-Darling GOF Test</b>                              |   |        |   |   |   |   |   |   |   |
| 3162 | 5% A-D Critical Value                                                                                                     | 0.681   | Detected data appear Gamma Distributed at 5% Significance Lev |   |        |   |   |   |   |   |   |   |
| 3163 | K-S Test Statistic                                                                                                        | 0.246   | <b>Kolmogorov-Smirnov GOF</b>                                 |   |        |   |   |   |   |   |   |   |
| 3164 | 5% K-S Critical Value                                                                                                     | 0.358   | Detected data appear Gamma Distributed at 5% Significance Lev |   |        |   |   |   |   |   |   |   |
| 3165 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                    |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3166 |                                                                                                                           |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3167 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3168 | k hat (MLE)                                                                                                               | 5.561   | k star (bias corrected MLE)                                   |   | 2.358  |   |   |   |   |   |   |   |
| 3169 | Theta hat (MLE)                                                                                                           | 0.0152  | Theta star (bias corrected MLE)                               |   | 0.0358 |   |   |   |   |   |   |   |
| 3170 | nu hat (MLE)                                                                                                              | 55.61   | nu star (bias corrected)                                      |   | 23.58  |   |   |   |   |   |   |   |
| 3171 | Mean (detects)                                                                                                            | 0.0844  |                                                               |   |        |   |   |   |   |   |   |   |
| 3172 |                                                                                                                           |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3173 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3174 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3175 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3176 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3177 | This is especially true when the sample size is small.                                                                    |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3178 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3179 | Minimum                                                                                                                   | 0.01    | Mean                                                          |   | 0.072  |   |   |   |   |   |   |   |
| 3180 | Maximum                                                                                                                   | 0.13    | Median                                                        |   | 0.064  |   |   |   |   |   |   |   |
| 3181 | SD                                                                                                                        | 0.0464  | CV                                                            |   | 0.644  |   |   |   |   |   |   |   |
| 3182 | k hat (MLE)                                                                                                               | 1.977   | k star (bias corrected MLE)                                   |   | 1.1    |   |   |   |   |   |   |   |
| 3183 | Theta hat (MLE)                                                                                                           | 0.0364  | Theta star (bias corrected MLE)                               |   | 0.0655 |   |   |   |   |   |   |   |
| 3184 | nu hat (MLE)                                                                                                              | 23.72   | nu star (bias corrected)                                      |   | 13.19  |   |   |   |   |   |   |   |
| 3185 | Adjusted Level of Significance ( $\beta$ )                                                                                | 0.0122  |                                                               |   |        |   |   |   |   |   |   |   |
| 3186 | Approximate Chi Square Value (13.19, $\alpha$ )                                                                           | 6.024   | Adjusted Chi Square Value (13.19, $\beta$ )                   |   | 4.395  |   |   |   |   |   |   |   |
| 3187 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         | 0.158   | 95% Gamma Adjusted UCL (use when $n < 50$ )                   |   | 0.216  |   |   |   |   |   |   |   |
| 3188 |                                                                                                                           |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3189 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3190 | Mean (KM)                                                                                                                 | 0.0767  | SD (KM)                                                       |   | 0.0364 |   |   |   |   |   |   |   |
| 3191 | Variance (KM)                                                                                                             | 0.00132 | SE of Mean (KM)                                               |   | 0.0166 |   |   |   |   |   |   |   |
| 3192 | k hat (KM)                                                                                                                | 4.44    | k star (KM)                                                   |   | 2.331  |   |   |   |   |   |   |   |
| 3193 | nu hat (KM)                                                                                                               | 53.28   | nu star (KM)                                                  |   | 27.97  |   |   |   |   |   |   |   |
| 3194 | theta hat (KM)                                                                                                            | 0.0173  | theta star (KM)                                               |   | 0.0329 |   |   |   |   |   |   |   |
| 3195 | 80% gamma percentile (KM)                                                                                                 | 0.113   | 90% gamma percentile (KM)                                     |   | 0.144  |   |   |   |   |   |   |   |
| 3196 | 95% gamma percentile (KM)                                                                                                 | 0.173   | 99% gamma percentile (KM)                                     |   | 0.238  |   |   |   |   |   |   |   |
| 3197 |                                                                                                                           |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3198 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3199 | Approximate Chi Square Value (27.97, $\alpha$ )                                                                           | 16.91   | Adjusted Chi Square Value (27.97, $\beta$ )                   |   | 13.9   |   |   |   |   |   |   |   |
| 3200 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       | 0.127   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )                |   | 0.154  |   |   |   |   |   |   |   |
| 3201 |                                                                                                                           |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3202 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3203 | Shapiro Wilk Test Statistic                                                                                               | 0.9     | <b>Shapiro Wilk GOF Test</b>                                  |   |        |   |   |   |   |   |   |   |
| 3204 | 5% Shapiro Wilk Critical Value                                                                                            | 0.762   | Detected Data appear Lognormal at 5% Significance Level       |   |        |   |   |   |   |   |   |   |
| 3205 | Lilliefors Test Statistic                                                                                                 | 0.219   | <b>Lilliefors GOF Test</b>                                    |   |        |   |   |   |   |   |   |   |
| 3206 | 5% Lilliefors Critical Value                                                                                              | 0.343   | Detected Data appear Lognormal at 5% Significance Level       |   |        |   |   |   |   |   |   |   |
| 3207 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                            |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3208 |                                                                                                                           |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3209 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3210 | Mean in Original Scale                                                                                                    | 0.074   | Mean in Log Scale                                             |   | -2.772 |   |   |   |   |   |   |   |
| 3211 | SD in Original Scale                                                                                                      | 0.0433  | SD in Log Scale                                               |   | 0.669  |   |   |   |   |   |   |   |
| 3212 | 95% t UCL (assumes normality of ROS data)                                                                                 | 0.11    | 95% Percentile Bootstrap UCL                                  |   | 0.101  |   |   |   |   |   |   |   |
| 3213 | 95% BCA Bootstrap UCL                                                                                                     | 0.104   | 95% Bootstrap t UCL                                           |   | 0.133  |   |   |   |   |   |   |   |
| 3214 | 95% H-UCL (Log ROS)                                                                                                       | 0.197   |                                                               |   |        |   |   |   |   |   |   |   |
| 3215 |                                                                                                                           |         |                                                               |   |        |   |   |   |   |   |   |   |
| 3216 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |         |                                                               |   |        |   |   |   |   |   |   |   |



|      | A                                                                                                                                        | B | C | D | E     | F                                           | G | H | I | J     | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|-------|---------------------------------------------|---|---|---|-------|---|---|--|
| 3284 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3285 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |   |   | 3021  | 95% Adjusted Gamma UCL (use when n<50)      |   |   |   | 5292  |   |   |  |
| 3286 |                                                                                                                                          |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3287 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3288 | Shapiro Wilk Test Statistic                                                                                                              |   |   |   | 0.704 | <b>Shapiro Wilk Lognormal GOF Test</b>      |   |   |   |       |   |   |  |
| 3289 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   |   | 0.803 | Data Not Lognormal at 5% Significance Level |   |   |   |       |   |   |  |
| 3290 | Lilliefors Test Statistic                                                                                                                |   |   |   | 0.328 | <b>Lilliefors Lognormal GOF Test</b>        |   |   |   |       |   |   |  |
| 3291 | 5% Lilliefors Critical Value                                                                                                             |   |   |   | 0.304 | Data Not Lognormal at 5% Significance Level |   |   |   |       |   |   |  |
| 3292 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3293 |                                                                                                                                          |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3294 | <b>Lognormal Statistics</b>                                                                                                              |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3295 | Minimum of Logged Data                                                                                                                   |   |   |   | 3.288 | Mean of logged Data                         |   |   |   | 4.648 |   |   |  |
| 3296 | Maximum of Logged Data                                                                                                                   |   |   |   | 8.253 | SD of logged Data                           |   |   |   | 1.649 |   |   |  |
| 3297 |                                                                                                                                          |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3298 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3299 | 95% H-UCL                                                                                                                                |   |   |   | 18206 | 90% Chebyshev (MVUE) UCL                    |   |   |   | 822.3 |   |   |  |
| 3300 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   |   | 1062  | 97.5% Chebyshev (MVUE) UCL                  |   |   |   | 1394  |   |   |  |
| 3301 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   |   | 2047  |                                             |   |   |   |       |   |   |  |
| 3302 |                                                                                                                                          |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3303 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3304 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3305 |                                                                                                                                          |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3306 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3307 | 95% CLT UCL                                                                                                                              |   |   |   | 1490  | 95% Jackknife UCL                           |   |   |   | 1651  |   |   |  |
| 3308 | 95% Standard Bootstrap UCL                                                                                                               |   |   |   | 1423  | 95% Bootstrap-t UCL                         |   |   |   | 54420 |   |   |  |
| 3309 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   |   | 32608 | 95% Percentile Bootstrap UCL                |   |   |   | 1676  |   |   |  |
| 3310 | 95% BCA Bootstrap UCL                                                                                                                    |   |   |   | 1697  |                                             |   |   |   |       |   |   |  |
| 3311 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   |   | 2222  | 95% Chebyshev(Mean, Sd) UCL                 |   |   |   | 2955  |   |   |  |
| 3312 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   |   | 3973  | 99% Chebyshev(Mean, Sd) UCL                 |   |   |   | 5972  |   |   |  |
| 3313 |                                                                                                                                          |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3314 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3315 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   |   | 32608 |                                             |   |   |   |       |   |   |  |
| 3316 |                                                                                                                                          |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3317 | <b>Recommended UCL exceeds the maximum observation</b>                                                                                   |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3318 |                                                                                                                                          |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3319 | <b>Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL</b>        |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3320 |                                                                                                                                          |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3321 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3322 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3323 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3324 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |   |       |                                             |   |   |   |       |   |   |  |
| 3325 |                                                                                                                                          |   |   |   |       |                                             |   |   |   |       |   |   |  |

|    | A                                                                                                          | B                             | C | D                                                               | E | F     | G | H | I | J | K | L |
|----|------------------------------------------------------------------------------------------------------------|-------------------------------|---|-----------------------------------------------------------------|---|-------|---|---|---|---|---|---|
| 1  | <b>UCL Statistics for Data Sets with Non-Detects</b>                                                       |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 2  |                                                                                                            |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 3  | User Selected Options                                                                                      |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 4  | Date/Time of Computation                                                                                   | ProUCL 5.12/1/2019 1:28:07 PM |   |                                                                 |   |       |   |   |   |   |   |   |
| 5  | From File                                                                                                  | BPMD_HHRA_SedInput_v3.xls     |   |                                                                 |   |       |   |   |   |   |   |   |
| 6  | Full Precision                                                                                             | OFF                           |   |                                                                 |   |       |   |   |   |   |   |   |
| 7  | Confidence Coefficient                                                                                     | 95%                           |   |                                                                 |   |       |   |   |   |   |   |   |
| 8  | Number of Bootstrap Operations                                                                             | 2000                          |   |                                                                 |   |       |   |   |   |   |   |   |
| 9  |                                                                                                            |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 10 |                                                                                                            |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 11 | <b>Result (eu6_arsenic)</b>                                                                                |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 12 |                                                                                                            |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 13 | <b>General Statistics</b>                                                                                  |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 14 | Total Number of Observations                                                                               | 4                             |   | Number of Distinct Observations                                 |   | 4     |   |   |   |   |   |   |
| 15 |                                                                                                            |                               |   | Number of Missing Observations                                  |   | 0     |   |   |   |   |   |   |
| 16 | Minimum                                                                                                    | 14.9                          |   | Mean                                                            |   | 21.1  |   |   |   |   |   |   |
| 17 | Maximum                                                                                                    | 29.2                          |   | Median                                                          |   | 20.15 |   |   |   |   |   |   |
| 18 | SD                                                                                                         | 5.951                         |   | Std. Error of Mean                                              |   | 2.976 |   |   |   |   |   |   |
| 19 | Coefficient of Variation                                                                                   | 0.282                         |   | Skewness                                                        |   | 0.918 |   |   |   |   |   |   |
| 20 |                                                                                                            |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 21 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b> |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 22 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>     |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 23 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                        |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 24 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>             |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 25 |                                                                                                            |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 26 | <b>Normal GOF Test</b>                                                                                     |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 27 | Shapiro Wilk Test Statistic                                                                                | 0.937                         |   | <b>Shapiro Wilk GOF Test</b>                                    |   |       |   |   |   |   |   |   |
| 28 | 5% Shapiro Wilk Critical Value                                                                             | 0.748                         |   | Data appear Normal at 5% Significance Level                     |   |       |   |   |   |   |   |   |
| 29 | Lilliefors Test Statistic                                                                                  | 0.283                         |   | <b>Lilliefors GOF Test</b>                                      |   |       |   |   |   |   |   |   |
| 30 | 5% Lilliefors Critical Value                                                                               | 0.375                         |   | Data appear Normal at 5% Significance Level                     |   |       |   |   |   |   |   |   |
| 31 | <b>Data appear Normal at 5% Significance Level</b>                                                         |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 32 |                                                                                                            |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 33 | <b>Assuming Normal Distribution</b>                                                                        |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 34 | <b>95% Normal UCL</b>                                                                                      |                               |   | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |       |   |   |   |   |   |   |
| 35 | 95% Student's-t UCL                                                                                        | 28.1                          |   | 95% Adjusted-CLT UCL (Chen-1995)                                |   | 27.45 |   |   |   |   |   |   |
| 36 |                                                                                                            |                               |   | 95% Modified-t UCL (Johnson-1978)                               |   | 28.33 |   |   |   |   |   |   |
| 37 |                                                                                                            |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 38 | <b>Gamma GOF Test</b>                                                                                      |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 39 | A-D Test Statistic                                                                                         | 0.287                         |   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |       |   |   |   |   |   |   |
| 40 | 5% A-D Critical Value                                                                                      | 0.657                         |   | Detected data appear Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |   |   |
| 41 | K-S Test Statistic                                                                                         | 0.258                         |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |       |   |   |   |   |   |   |
| 42 | 5% K-S Critical Value                                                                                      | 0.394                         |   | Detected data appear Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |   |   |
| 43 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                     |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 44 |                                                                                                            |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 45 | <b>Gamma Statistics</b>                                                                                    |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 46 | k hat (MLE)                                                                                                | 17.46                         |   | k star (bias corrected MLE)                                     |   | 4.531 |   |   |   |   |   |   |
| 47 | Theta hat (MLE)                                                                                            | 1.209                         |   | Theta star (bias corrected MLE)                                 |   | 4.657 |   |   |   |   |   |   |
| 48 | nu hat (MLE)                                                                                               | 139.7                         |   | nu star (bias corrected)                                        |   | 36.25 |   |   |   |   |   |   |
| 49 | MLE Mean (bias corrected)                                                                                  | 21.1                          |   | MLE Sd (bias corrected)                                         |   | 9.912 |   |   |   |   |   |   |
| 50 |                                                                                                            |                               |   | Approximate Chi Square Value (0.05)                             |   | 23.47 |   |   |   |   |   |   |
| 51 | Adjusted Level of Significance                                                                             | N/A                           |   | Adjusted Chi Square Value                                       |   | N/A   |   |   |   |   |   |   |
| 52 |                                                                                                            |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 53 | <b>Assuming Gamma Distribution</b>                                                                         |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 54 | 95% Approximate Gamma UCL (use when n>=50))                                                                | 32.59                         |   | 95% Adjusted Gamma UCL (use when n<50)                          |   | N/A   |   |   |   |   |   |   |
| 55 |                                                                                                            |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 56 | <b>Lognormal GOF Test</b>                                                                                  |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 57 | Shapiro Wilk Test Statistic                                                                                | 0.966                         |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |       |   |   |   |   |   |   |
| 58 | 5% Shapiro Wilk Critical Value                                                                             | 0.748                         |   | Data appear Lognormal at 5% Significance Level                  |   |       |   |   |   |   |   |   |
| 59 | Lilliefors Test Statistic                                                                                  | 0.243                         |   | <b>Lilliefors Lognormal GOF Test</b>                            |   |       |   |   |   |   |   |   |
| 60 | 5% Lilliefors Critical Value                                                                               | 0.375                         |   | Data appear Lognormal at 5% Significance Level                  |   |       |   |   |   |   |   |   |
| 61 | <b>Data appear Lognormal at 5% Significance Level</b>                                                      |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 62 |                                                                                                            |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 63 | <b>Lognormal Statistics</b>                                                                                |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 64 | Minimum of Logged Data                                                                                     | 2.701                         |   | Mean of logged Data                                             |   | 3.02  |   |   |   |   |   |   |
| 65 | Maximum of Logged Data                                                                                     | 3.374                         |   | SD of logged Data                                               |   | 0.276 |   |   |   |   |   |   |
| 66 |                                                                                                            |                               |   |                                                                 |   |       |   |   |   |   |   |   |
| 67 | <b>Assuming Lognormal Distribution</b>                                                                     |                               |   |                                                                 |   |       |   |   |   |   |   |   |

|     | A                                                                                                                                        | B | C | D | E                              | F     | G | H | I | J | K                                                               | L      |  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|--------------------------------|-------|---|---|---|---|-----------------------------------------------------------------|--------|--|
| 68  |                                                                                                                                          |   |   |   | 95% H-UCL                      | 32.72 |   |   |   |   | 90% Chebyshev (MVUE) UCL                                        | 29.77  |  |
| 69  |                                                                                                                                          |   |   |   | 95% Chebyshev (MVUE) UCL       | 33.7  |   |   |   |   | 97.5% Chebyshev (MVUE) UCL                                      | 39.16  |  |
| 70  |                                                                                                                                          |   |   |   | 99% Chebyshev (MVUE) UCL       | 49.88 |   |   |   |   |                                                                 |        |  |
| 71  |                                                                                                                                          |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 72  | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 73  | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 74  |                                                                                                                                          |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 75  | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 76  |                                                                                                                                          |   |   |   | 95% CLT UCL                    | 25.99 |   |   |   |   | 95% Jackknife UCL                                               | 28.1   |  |
| 77  |                                                                                                                                          |   |   |   | 95% Standard Bootstrap UCL     | N/A   |   |   |   |   | 95% Bootstrap-t UCL                                             | N/A    |  |
| 78  |                                                                                                                                          |   |   |   | 95% Hall's Bootstrap UCL       | N/A   |   |   |   |   | 95% Percentile Bootstrap UCL                                    | N/A    |  |
| 79  |                                                                                                                                          |   |   |   | 95% BCA Bootstrap UCL          | N/A   |   |   |   |   |                                                                 |        |  |
| 80  |                                                                                                                                          |   |   |   | 90% Chebyshev(Mean, Sd) UCL    | 30.03 |   |   |   |   | 95% Chebyshev(Mean, Sd) UCL                                     | 34.07  |  |
| 81  |                                                                                                                                          |   |   |   | 97.5% Chebyshev(Mean, Sd) UCL  | 39.68 |   |   |   |   | 99% Chebyshev(Mean, Sd) UCL                                     | 50.71  |  |
| 82  |                                                                                                                                          |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 83  | <b>Suggested UCL to Use</b>                                                                                                              |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 84  |                                                                                                                                          |   |   |   | 95% Student's-t UCL            | 28.1  |   |   |   |   |                                                                 |        |  |
| 85  |                                                                                                                                          |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 86  | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 87  | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 88  | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 89  | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 90  |                                                                                                                                          |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 91  |                                                                                                                                          |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 92  | <b>Result (eu6_cadmium)</b>                                                                                                              |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 93  |                                                                                                                                          |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 94  | <b>General Statistics</b>                                                                                                                |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 95  |                                                                                                                                          |   |   |   | Total Number of Observations   | 4     |   |   |   |   | Number of Distinct Observations                                 | 4      |  |
| 96  |                                                                                                                                          |   |   |   |                                |       |   |   |   |   | Number of Missing Observations                                  | 0      |  |
| 97  |                                                                                                                                          |   |   |   | Minimum                        | 2     |   |   |   |   | Mean                                                            | 2.813  |  |
| 98  |                                                                                                                                          |   |   |   | Maximum                        | 3.45  |   |   |   |   | Median                                                          | 2.9    |  |
| 99  |                                                                                                                                          |   |   |   | SD                             | 0.684 |   |   |   |   | Std. Error of Mean                                              | 0.342  |  |
| 100 |                                                                                                                                          |   |   |   | Coefficient of Variation       | 0.243 |   |   |   |   | Skewness                                                        | -0.401 |  |
| 101 |                                                                                                                                          |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 102 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 103 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 104 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 105 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 106 |                                                                                                                                          |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 107 | <b>Normal GOF Test</b>                                                                                                                   |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 108 |                                                                                                                                          |   |   |   | Shapiro Wilk Test Statistic    | 0.912 |   |   |   |   | <b>Shapiro Wilk GOF Test</b>                                    |        |  |
| 109 |                                                                                                                                          |   |   |   | 5% Shapiro Wilk Critical Value | 0.748 |   |   |   |   | Data appear Normal at 5% Significance Level                     |        |  |
| 110 |                                                                                                                                          |   |   |   | Lilliefors Test Statistic      | 0.262 |   |   |   |   | <b>Lilliefors GOF Test</b>                                      |        |  |
| 111 |                                                                                                                                          |   |   |   | 5% Lilliefors Critical Value   | 0.375 |   |   |   |   | Data appear Normal at 5% Significance Level                     |        |  |
| 112 | <b>Data appear Normal at 5% Significance Level</b>                                                                                       |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 113 |                                                                                                                                          |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 114 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 115 |                                                                                                                                          |   |   |   | <b>95% Normal UCL</b>          |       |   |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b>                         |        |  |
| 116 |                                                                                                                                          |   |   |   | 95% Student's-t UCL            | 3.617 |   |   |   |   | 95% Adjusted-CLT UCL (Chen-1995)                                | 3.302  |  |
| 117 |                                                                                                                                          |   |   |   |                                |       |   |   |   |   | 95% Modified-t UCL (Johnson-1978)                               | 3.605  |  |
| 118 |                                                                                                                                          |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 119 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 120 |                                                                                                                                          |   |   |   | A-D Test Statistic             | 0.351 |   |   |   |   | <b>Anderson-Darling Gamma GOF Test</b>                          |        |  |
| 121 |                                                                                                                                          |   |   |   | 5% A-D Critical Value          | 0.657 |   |   |   |   | Detected data appear Gamma Distributed at 5% Significance Level |        |  |
| 122 |                                                                                                                                          |   |   |   | K-S Test Statistic             | 0.297 |   |   |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |        |  |
| 123 |                                                                                                                                          |   |   |   | 5% K-S Critical Value          | 0.394 |   |   |   |   | Detected data appear Gamma Distributed at 5% Significance Level |        |  |
| 124 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 125 |                                                                                                                                          |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 126 | <b>Gamma Statistics</b>                                                                                                                  |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 127 |                                                                                                                                          |   |   |   | k hat (MLE)                    | 21.32 |   |   |   |   | k star (bias corrected MLE)                                     | 5.496  |  |
| 128 |                                                                                                                                          |   |   |   | Theta hat (MLE)                | 0.132 |   |   |   |   | Theta star (bias corrected MLE)                                 | 0.512  |  |
| 129 |                                                                                                                                          |   |   |   | nu hat (MLE)                   | 170.5 |   |   |   |   | nu star (bias corrected)                                        | 43.96  |  |
| 130 |                                                                                                                                          |   |   |   | MLE Mean (bias corrected)      | 2.813 |   |   |   |   | MLE Sd (bias corrected)                                         | 1.2    |  |
| 131 |                                                                                                                                          |   |   |   |                                |       |   |   |   |   | Approximate Chi Square Value (0.05)                             | 29.76  |  |
| 132 |                                                                                                                                          |   |   |   | Adjusted Level of Significance | N/A   |   |   |   |   | Adjusted Chi Square Value                                       | N/A    |  |
| 133 |                                                                                                                                          |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |
| 134 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |   |                                |       |   |   |   |   |                                                                 |        |  |

| A   | B                                                                                                                                                                                                                    | C | D     | E                                | F                                              | G | H     | I      | J | K | L |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------|----------------------------------|------------------------------------------------|---|-------|--------|---|---|---|
| 135 | 95% Approximate Gamma UCL (use when n>=50))                                                                                                                                                                          |   |       | 4.155                            | 95% Adjusted Gamma UCL (use when n<50)         |   |       | N/A    |   |   |   |
| 136 |                                                                                                                                                                                                                      |   |       |                                  |                                                |   |       |        |   |   |   |
| 137 | <b>Lognormal GOF Test</b>                                                                                                                                                                                            |   |       |                                  |                                                |   |       |        |   |   |   |
| 138 | Shapiro Wilk Test Statistic                                                                                                                                                                                          |   |       | 0.909                            | <b>Shapiro Wilk Lognormal GOF Test</b>         |   |       |        |   |   |   |
| 139 | 5% Shapiro Wilk Critical Value                                                                                                                                                                                       |   |       | 0.748                            | Data appear Lognormal at 5% Significance Level |   |       |        |   |   |   |
| 140 | Lilliefors Test Statistic                                                                                                                                                                                            |   |       | 0.264                            | <b>Lilliefors Lognormal GOF Test</b>           |   |       |        |   |   |   |
| 141 | 5% Lilliefors Critical Value                                                                                                                                                                                         |   |       | 0.375                            | Data appear Lognormal at 5% Significance Level |   |       |        |   |   |   |
| 142 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                                                                                                |   |       |                                  |                                                |   |       |        |   |   |   |
| 143 |                                                                                                                                                                                                                      |   |       |                                  |                                                |   |       |        |   |   |   |
| 144 | <b>Lognormal Statistics</b>                                                                                                                                                                                          |   |       |                                  |                                                |   |       |        |   |   |   |
| 145 | Minimum of Logged Data                                                                                                                                                                                               |   |       | 0.693                            | Mean of logged Data                            |   |       | 1.01   |   |   |   |
| 146 | Maximum of Logged Data                                                                                                                                                                                               |   |       | 1.238                            | SD of logged Data                              |   |       | 0.255  |   |   |   |
| 147 |                                                                                                                                                                                                                      |   |       |                                  |                                                |   |       |        |   |   |   |
| 148 | <b>Assuming Lognormal Distribution</b>                                                                                                                                                                               |   |       |                                  |                                                |   |       |        |   |   |   |
| 149 | 95% H-UCL                                                                                                                                                                                                            |   | 4.178 | 90% Chebyshev (MVUE) UCL         |                                                |   | 3.886 |        |   |   |   |
| 150 | 95% Chebyshev (MVUE) UCL                                                                                                                                                                                             |   | 4.371 | 97.5% Chebyshev (MVUE) UCL       |                                                |   | 5.045 |        |   |   |   |
| 151 | 99% Chebyshev (MVUE) UCL                                                                                                                                                                                             |   | 6.368 |                                  |                                                |   |       |        |   |   |   |
| 152 |                                                                                                                                                                                                                      |   |       |                                  |                                                |   |       |        |   |   |   |
| 153 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                                                                                                |   |       |                                  |                                                |   |       |        |   |   |   |
| 154 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                                                                                                     |   |       |                                  |                                                |   |       |        |   |   |   |
| 155 |                                                                                                                                                                                                                      |   |       |                                  |                                                |   |       |        |   |   |   |
| 156 | <b>Nonparametric Distribution Free UCLs</b>                                                                                                                                                                          |   |       |                                  |                                                |   |       |        |   |   |   |
| 157 | 95% CLT UCL                                                                                                                                                                                                          |   | 3.375 | 95% Jackknife UCL                |                                                |   | 3.617 |        |   |   |   |
| 158 | 95% Standard Bootstrap UCL                                                                                                                                                                                           |   | N/A   | 95% Bootstrap-t UCL              |                                                |   | N/A   |        |   |   |   |
| 159 | 95% Hall's Bootstrap UCL                                                                                                                                                                                             |   | N/A   | 95% Percentile Bootstrap UCL     |                                                |   | N/A   |        |   |   |   |
| 160 | 95% BCA Bootstrap UCL                                                                                                                                                                                                |   | N/A   |                                  |                                                |   |       |        |   |   |   |
| 161 | 90% Chebyshev(Mean, Sd) UCL                                                                                                                                                                                          |   | 3.838 | 95% Chebyshev(Mean, Sd) UCL      |                                                |   | 4.302 |        |   |   |   |
| 162 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                                                                                                        |   | 4.947 | 99% Chebyshev(Mean, Sd) UCL      |                                                |   | 6.213 |        |   |   |   |
| 163 |                                                                                                                                                                                                                      |   |       |                                  |                                                |   |       |        |   |   |   |
| 164 | <b>Suggested UCL to Use</b>                                                                                                                                                                                          |   |       |                                  |                                                |   |       |        |   |   |   |
| 165 | 95% Student's-t UCL                                                                                                                                                                                                  |   | 3.617 |                                  |                                                |   |       |        |   |   |   |
| 166 |                                                                                                                                                                                                                      |   |       |                                  |                                                |   |       |        |   |   |   |
| 167 | <b>Recommended UCL exceeds the maximum observation</b>                                                                                                                                                               |   |       |                                  |                                                |   |       |        |   |   |   |
| 168 |                                                                                                                                                                                                                      |   |       |                                  |                                                |   |       |        |   |   |   |
| 169 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.                                                                                         |   |       |                                  |                                                |   |       |        |   |   |   |
| 170 | Recommendations are based upon data size, data distribution, and skewness.                                                                                                                                           |   |       |                                  |                                                |   |       |        |   |   |   |
| 171 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                                                                                             |   |       |                                  |                                                |   |       |        |   |   |   |
| 172 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician                                                                             |   |       |                                  |                                                |   |       |        |   |   |   |
| 173 |                                                                                                                                                                                                                      |   |       |                                  |                                                |   |       |        |   |   |   |
| 174 | <b>Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.</b> |   |       |                                  |                                                |   |       |        |   |   |   |
| 175 |                                                                                                                                                                                                                      |   |       |                                  |                                                |   |       |        |   |   |   |
| 176 |                                                                                                                                                                                                                      |   |       |                                  |                                                |   |       |        |   |   |   |
| 177 |                                                                                                                                                                                                                      |   |       |                                  |                                                |   |       |        |   |   |   |
| 178 | <b>Result (eu6_chromium)</b>                                                                                                                                                                                         |   |       |                                  |                                                |   |       |        |   |   |   |
| 179 |                                                                                                                                                                                                                      |   |       |                                  |                                                |   |       |        |   |   |   |
| 180 | <b>General Statistics</b>                                                                                                                                                                                            |   |       |                                  |                                                |   |       |        |   |   |   |
| 181 | Total Number of Observations                                                                                                                                                                                         |   |       | 4                                | Number of Distinct Observations                |   |       | 4      |   |   |   |
| 182 |                                                                                                                                                                                                                      |   |       |                                  | Number of Missing Observations                 |   |       | 0      |   |   |   |
| 183 | Minimum                                                                                                                                                                                                              |   |       | 1.4                              | Mean                                           |   |       | 2.463  |   |   |   |
| 184 | Maximum                                                                                                                                                                                                              |   |       | 3.3                              | Median                                         |   |       | 2.575  |   |   |   |
| 185 | SD                                                                                                                                                                                                                   |   |       | 0.86                             | Std. Error of Mean                             |   |       | 0.43   |   |   |   |
| 186 | Coefficient of Variation                                                                                                                                                                                             |   |       | 0.349                            | Skewness                                       |   |       | -0.511 |   |   |   |
| 187 |                                                                                                                                                                                                                      |   |       |                                  |                                                |   |       |        |   |   |   |
| 188 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>           |   |       |                                  |                                                |   |       |        |   |   |   |
| 189 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                                                                                                  |   |       |                                  |                                                |   |       |        |   |   |   |
| 190 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                                                                                                       |   |       |                                  |                                                |   |       |        |   |   |   |
| 191 |                                                                                                                                                                                                                      |   |       |                                  |                                                |   |       |        |   |   |   |
| 192 |                                                                                                                                                                                                                      |   |       |                                  |                                                |   |       |        |   |   |   |
| 193 | <b>Normal GOF Test</b>                                                                                                                                                                                               |   |       |                                  |                                                |   |       |        |   |   |   |
| 194 | Shapiro Wilk Test Statistic                                                                                                                                                                                          |   |       | 0.946                            | <b>Shapiro Wilk GOF Test</b>                   |   |       |        |   |   |   |
| 195 | 5% Shapiro Wilk Critical Value                                                                                                                                                                                       |   |       | 0.748                            | Data appear Normal at 5% Significance Level    |   |       |        |   |   |   |
| 196 | Lilliefors Test Statistic                                                                                                                                                                                            |   |       | 0.234                            | <b>Lilliefors GOF Test</b>                     |   |       |        |   |   |   |
| 197 | 5% Lilliefors Critical Value                                                                                                                                                                                         |   |       | 0.375                            | Data appear Normal at 5% Significance Level    |   |       |        |   |   |   |
| 198 | <b>Data appear Normal at 5% Significance Level</b>                                                                                                                                                                   |   |       |                                  |                                                |   |       |        |   |   |   |
| 199 |                                                                                                                                                                                                                      |   |       |                                  |                                                |   |       |        |   |   |   |
| 200 | <b>Assuming Normal Distribution</b>                                                                                                                                                                                  |   |       |                                  |                                                |   |       |        |   |   |   |
| 201 | 95% Normal UCL                                                                                                                                                                                                       |   |       | 95% UCLs (Adjusted for Skewness) |                                                |   |       |        |   |   |   |

| A   | B | C | D                                                                                                                                                                                                                    | E | F     | G | H | I | J                                                               | K | L     |
|-----|---|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------|---|---|---|-----------------------------------------------------------------|---|-------|
| 202 |   |   | 95% Student's-t UCL                                                                                                                                                                                                  |   | 3.474 |   |   |   | 95% Adjusted-CLT UCL (Chen-1995)                                |   | 3.052 |
| 203 |   |   |                                                                                                                                                                                                                      |   |       |   |   |   | 95% Modified-t UCL (Johnson-1978)                               |   | 3.456 |
| 204 |   |   |                                                                                                                                                                                                                      |   |       |   |   |   |                                                                 |   |       |
| 205 |   |   | <b>Gamma GOF Test</b>                                                                                                                                                                                                |   |       |   |   |   |                                                                 |   |       |
| 206 |   |   | A-D Test Statistic                                                                                                                                                                                                   |   | 0.306 |   |   |   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |       |
| 207 |   |   | 5% A-D Critical Value                                                                                                                                                                                                |   | 0.657 |   |   |   | detected data appear Gamma Distributed at 5% Significance Level |   |       |
| 208 |   |   | K-S Test Statistic                                                                                                                                                                                                   |   | 0.271 |   |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |       |
| 209 |   |   | 5% K-S Critical Value                                                                                                                                                                                                |   | 0.395 |   |   |   | detected data appear Gamma Distributed at 5% Significance Level |   |       |
| 210 |   |   | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                                                                                               |   |       |   |   |   |                                                                 |   |       |
| 211 |   |   |                                                                                                                                                                                                                      |   |       |   |   |   |                                                                 |   |       |
| 212 |   |   | <b>Gamma Statistics</b>                                                                                                                                                                                              |   |       |   |   |   |                                                                 |   |       |
| 213 |   |   | k hat (MLE)                                                                                                                                                                                                          |   | 9.677 |   |   |   | k star (bias corrected MLE)                                     |   | 2.586 |
| 214 |   |   | Theta hat (MLE)                                                                                                                                                                                                      |   | 0.254 |   |   |   | Theta star (bias corrected MLE)                                 |   | 0.952 |
| 215 |   |   | nu hat (MLE)                                                                                                                                                                                                         |   | 77.42 |   |   |   | nu star (bias corrected)                                        |   | 20.69 |
| 216 |   |   | MLE Mean (bias corrected)                                                                                                                                                                                            |   | 2.463 |   |   |   | MLE Sd (bias corrected)                                         |   | 1.531 |
| 217 |   |   |                                                                                                                                                                                                                      |   |       |   |   |   | Approximate Chi Square Value (0.05)                             |   | 11.36 |
| 218 |   |   | Adjusted Level of Significance                                                                                                                                                                                       |   | N/A   |   |   |   | Adjusted Chi Square Value                                       |   | N/A   |
| 219 |   |   |                                                                                                                                                                                                                      |   |       |   |   |   |                                                                 |   |       |
| 220 |   |   | <b>Assuming Gamma Distribution</b>                                                                                                                                                                                   |   |       |   |   |   |                                                                 |   |       |
| 221 |   |   | 95% Approximate Gamma UCL (use when n>=50))                                                                                                                                                                          |   | 4.485 |   |   |   | 95% Adjusted Gamma UCL (use when n<50)                          |   | N/A   |
| 222 |   |   |                                                                                                                                                                                                                      |   |       |   |   |   |                                                                 |   |       |
| 223 |   |   | <b>Lognormal GOF Test</b>                                                                                                                                                                                            |   |       |   |   |   |                                                                 |   |       |
| 224 |   |   | Shapiro Wilk Test Statistic                                                                                                                                                                                          |   | 0.923 |   |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |       |
| 225 |   |   | 5% Shapiro Wilk Critical Value                                                                                                                                                                                       |   | 0.748 |   |   |   | Data appear Lognormal at 5% Significance Level                  |   |       |
| 226 |   |   | Lilliefors Test Statistic                                                                                                                                                                                            |   | 0.24  |   |   |   | <b>Lilliefors Lognormal GOF Test</b>                            |   |       |
| 227 |   |   | 5% Lilliefors Critical Value                                                                                                                                                                                         |   | 0.375 |   |   |   | Data appear Lognormal at 5% Significance Level                  |   |       |
| 228 |   |   | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                                                                                                |   |       |   |   |   |                                                                 |   |       |
| 229 |   |   |                                                                                                                                                                                                                      |   |       |   |   |   |                                                                 |   |       |
| 230 |   |   | <b>Lognormal Statistics</b>                                                                                                                                                                                          |   |       |   |   |   |                                                                 |   |       |
| 231 |   |   | Minimum of Logged Data                                                                                                                                                                                               |   | 0.336 |   |   |   | Mean of logged Data                                             |   | 0.849 |
| 232 |   |   | Maximum of Logged Data                                                                                                                                                                                               |   | 1.194 |   |   |   | SD of logged Data                                               |   | 0.388 |
| 233 |   |   |                                                                                                                                                                                                                      |   |       |   |   |   |                                                                 |   |       |
| 234 |   |   | <b>Assuming Lognormal Distribution</b>                                                                                                                                                                               |   |       |   |   |   |                                                                 |   |       |
| 235 |   |   | 95% H-UCL                                                                                                                                                                                                            |   | 5.066 |   |   |   | 90% Chebyshev (MVUE) UCL                                        |   | 3.891 |
| 236 |   |   | 95% Chebyshev (MVUE) UCL                                                                                                                                                                                             |   | 4.534 |   |   |   | 97.5% Chebyshev (MVUE) UCL                                      |   | 5.427 |
| 237 |   |   | 99% Chebyshev (MVUE) UCL                                                                                                                                                                                             |   | 7.182 |   |   |   |                                                                 |   |       |
| 238 |   |   |                                                                                                                                                                                                                      |   |       |   |   |   |                                                                 |   |       |
| 239 |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                                                                                                |   |       |   |   |   |                                                                 |   |       |
| 240 |   |   | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                                                                                                     |   |       |   |   |   |                                                                 |   |       |
| 241 |   |   |                                                                                                                                                                                                                      |   |       |   |   |   |                                                                 |   |       |
| 242 |   |   | <b>Nonparametric Distribution Free UCLs</b>                                                                                                                                                                          |   |       |   |   |   |                                                                 |   |       |
| 243 |   |   | 95% CLT UCL                                                                                                                                                                                                          |   | 3.169 |   |   |   | 95% Jackknife UCL                                               |   | 3.474 |
| 244 |   |   | 95% Standard Bootstrap UCL                                                                                                                                                                                           |   | N/A   |   |   |   | 95% Bootstrap-t UCL                                             |   | N/A   |
| 245 |   |   | 95% Hall's Bootstrap UCL                                                                                                                                                                                             |   | N/A   |   |   |   | 95% Percentile Bootstrap UCL                                    |   | N/A   |
| 246 |   |   | 95% BCA Bootstrap UCL                                                                                                                                                                                                |   | N/A   |   |   |   |                                                                 |   |       |
| 247 |   |   | 90% Chebyshev(Mean, Sd) UCL                                                                                                                                                                                          |   | 3.752 |   |   |   | 95% Chebyshev(Mean, Sd) UCL                                     |   | 4.336 |
| 248 |   |   | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                                                                                                        |   | 5.147 |   |   |   | 99% Chebyshev(Mean, Sd) UCL                                     |   | 6.739 |
| 249 |   |   |                                                                                                                                                                                                                      |   |       |   |   |   |                                                                 |   |       |
| 250 |   |   | <b>Suggested UCL to Use</b>                                                                                                                                                                                          |   |       |   |   |   |                                                                 |   |       |
| 251 |   |   | 95% Student's-t UCL                                                                                                                                                                                                  |   | 3.474 |   |   |   |                                                                 |   |       |
| 252 |   |   |                                                                                                                                                                                                                      |   |       |   |   |   |                                                                 |   |       |
| 253 |   |   | <b>Recommended UCL exceeds the maximum observation</b>                                                                                                                                                               |   |       |   |   |   |                                                                 |   |       |
| 254 |   |   |                                                                                                                                                                                                                      |   |       |   |   |   |                                                                 |   |       |
| 255 |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.                                                                                         |   |       |   |   |   |                                                                 |   |       |
| 256 |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                                                                                                           |   |       |   |   |   |                                                                 |   |       |
| 257 |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                                                                                             |   |       |   |   |   |                                                                 |   |       |
| 258 |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician                                                                             |   |       |   |   |   |                                                                 |   |       |
| 259 |   |   |                                                                                                                                                                                                                      |   |       |   |   |   |                                                                 |   |       |
| 260 |   |   | <b>Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.</b> |   |       |   |   |   |                                                                 |   |       |
| 261 |   |   |                                                                                                                                                                                                                      |   |       |   |   |   |                                                                 |   |       |
| 262 |   |   |                                                                                                                                                                                                                      |   |       |   |   |   |                                                                 |   |       |
| 263 |   |   |                                                                                                                                                                                                                      |   |       |   |   |   |                                                                 |   |       |
| 264 |   |   | <b>Result (eu6_cobalt)</b>                                                                                                                                                                                           |   |       |   |   |   |                                                                 |   |       |
| 265 |   |   |                                                                                                                                                                                                                      |   |       |   |   |   |                                                                 |   |       |
| 266 |   |   | <b>General Statistics</b>                                                                                                                                                                                            |   |       |   |   |   |                                                                 |   |       |
| 267 |   |   | Total Number of Observations                                                                                                                                                                                         |   | 3     |   |   |   | Number of Distinct Observations                                 |   | 3     |
| 268 |   |   |                                                                                                                                                                                                                      |   |       |   |   |   | Number of Missing Observations                                  |   | 0     |

| A   | B                                                                                                          | C | D | E                                           | F     | G                                       | H | I | J | K                                              | L      |
|-----|------------------------------------------------------------------------------------------------------------|---|---|---------------------------------------------|-------|-----------------------------------------|---|---|---|------------------------------------------------|--------|
| 269 |                                                                                                            |   |   | Minimum                                     | 11.1  |                                         |   |   |   | Mean                                           | 20.1   |
| 270 |                                                                                                            |   |   | Maximum                                     | 27.5  |                                         |   |   |   | Median                                         | 21.7   |
| 271 |                                                                                                            |   |   | SD                                          | 8.316 |                                         |   |   |   | Std. Error of Mean                             | 4.801  |
| 272 |                                                                                                            |   |   | Coefficient of Variation                    | 0.414 |                                         |   |   |   | Skewness                                       | -0.834 |
| 273 |                                                                                                            |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 274 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b> |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 275 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>     |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 276 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                        |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 277 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>             |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 278 |                                                                                                            |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 279 | <b>Normal GOF Test</b>                                                                                     |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 280 |                                                                                                            |   |   | Shapiro Wilk Test Statistic                 | 0.972 |                                         |   |   |   | <b>Shapiro Wilk GOF Test</b>                   |        |
| 281 |                                                                                                            |   |   | 5% Shapiro Wilk Critical Value              | 0.767 |                                         |   |   |   | Data appear Normal at 5% Significance Level    |        |
| 282 |                                                                                                            |   |   | Lilliefors Test Statistic                   | 0.243 |                                         |   |   |   | <b>Lilliefors GOF Test</b>                     |        |
| 283 |                                                                                                            |   |   | 5% Lilliefors Critical Value                | 0.425 |                                         |   |   |   | Data appear Normal at 5% Significance Level    |        |
| 284 | <b>Data appear Normal at 5% Significance Level</b>                                                         |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 285 |                                                                                                            |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 286 | <b>Assuming Normal Distribution</b>                                                                        |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 287 | <b>95% Normal UCL</b>                                                                                      |   |   |                                             |       | <b>95% UCLs (Adjusted for Skewness)</b> |   |   |   |                                                |        |
| 288 |                                                                                                            |   |   | 95% Student's-t UCL                         | 34.12 |                                         |   |   |   | 95% Adjusted-CLT UCL (Chen-1995)               | 25.53  |
| 289 |                                                                                                            |   |   |                                             |       |                                         |   |   |   | 95% Modified-t UCL (Johnson-1978)              | 33.73  |
| 290 |                                                                                                            |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 291 | <b>Gamma GOF Test</b>                                                                                      |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 292 | <b>Not Enough Data to Perform GOF Test</b>                                                                 |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 293 |                                                                                                            |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 294 | <b>Gamma Statistics</b>                                                                                    |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 295 |                                                                                                            |   |   | k hat (MLE)                                 | 7.526 |                                         |   |   |   | k star (bias corrected MLE)                    | N/A    |
| 296 |                                                                                                            |   |   | Theta hat (MLE)                             | 2.671 |                                         |   |   |   | Theta star (bias corrected MLE)                | N/A    |
| 297 |                                                                                                            |   |   | nu hat (MLE)                                | 45.16 |                                         |   |   |   | nu star (bias corrected)                       | N/A    |
| 298 |                                                                                                            |   |   | MLE Mean (bias corrected)                   | N/A   |                                         |   |   |   | MLE Sd (bias corrected)                        | N/A    |
| 299 |                                                                                                            |   |   |                                             |       |                                         |   |   |   | Approximate Chi Square Value (0.05)            | N/A    |
| 300 |                                                                                                            |   |   | Adjusted Level of Significance              | N/A   |                                         |   |   |   | Adjusted Chi Square Value                      | N/A    |
| 301 |                                                                                                            |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 302 | <b>Assuming Gamma Distribution</b>                                                                         |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 303 |                                                                                                            |   |   | 95% Approximate Gamma UCL (use when n>=50)) | N/A   |                                         |   |   |   | 95% Adjusted Gamma UCL (use when n<50)         | N/A    |
| 304 |                                                                                                            |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 305 | <b>Lognormal GOF Test</b>                                                                                  |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 306 |                                                                                                            |   |   | Shapiro Wilk Test Statistic                 | 0.929 |                                         |   |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>         |        |
| 307 |                                                                                                            |   |   | 5% Shapiro Wilk Critical Value              | 0.767 |                                         |   |   |   | Data appear Lognormal at 5% Significance Level |        |
| 308 |                                                                                                            |   |   | Lilliefors Test Statistic                   | 0.287 |                                         |   |   |   | <b>Lilliefors Lognormal GOF Test</b>           |        |
| 309 |                                                                                                            |   |   | 5% Lilliefors Critical Value                | 0.425 |                                         |   |   |   | Data appear Lognormal at 5% Significance Level |        |
| 310 | <b>Data appear Lognormal at 5% Significance Level</b>                                                      |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 311 |                                                                                                            |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 312 | <b>Lognormal Statistics</b>                                                                                |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 313 |                                                                                                            |   |   | Minimum of Logged Data                      | 2.407 |                                         |   |   |   | Mean of logged Data                            | 2.933  |
| 314 |                                                                                                            |   |   | Maximum of Logged Data                      | 3.314 |                                         |   |   |   | SD of logged Data                              | 0.471  |
| 315 |                                                                                                            |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 316 | <b>Assuming Lognormal Distribution</b>                                                                     |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 317 |                                                                                                            |   |   | 95% H-UCL                                   | 159.8 |                                         |   |   |   | 90% Chebyshev (MVUE) UCL                       | 36.21  |
| 318 |                                                                                                            |   |   | 95% Chebyshev (MVUE) UCL                    | 43.47 |                                         |   |   |   | 97.5% Chebyshev (MVUE) UCL                     | 53.54  |
| 319 |                                                                                                            |   |   | 99% Chebyshev (MVUE) UCL                    | 73.32 |                                         |   |   |   |                                                |        |
| 320 |                                                                                                            |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 321 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                      |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 322 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                           |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 323 |                                                                                                            |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 324 | <b>Nonparametric Distribution Free UCLs</b>                                                                |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 325 |                                                                                                            |   |   | 95% CLT UCL                                 | 28    |                                         |   |   |   | 95% Jackknife UCL                              | 34.12  |
| 326 |                                                                                                            |   |   | 95% Standard Bootstrap UCL                  | N/A   |                                         |   |   |   | 95% Bootstrap-t UCL                            | N/A    |
| 327 |                                                                                                            |   |   | 95% Hall's Bootstrap UCL                    | N/A   |                                         |   |   |   | 95% Percentile Bootstrap UCL                   | N/A    |
| 328 |                                                                                                            |   |   | 95% BCA Bootstrap UCL                       | N/A   |                                         |   |   |   |                                                |        |
| 329 |                                                                                                            |   |   | 90% Chebyshev(Mean, Sd) UCL                 | 34.5  |                                         |   |   |   | 95% Chebyshev(Mean, Sd) UCL                    | 41.03  |
| 330 |                                                                                                            |   |   | 97.5% Chebyshev(Mean, Sd) UCL               | 50.08 |                                         |   |   |   | 99% Chebyshev(Mean, Sd) UCL                    | 67.87  |
| 331 |                                                                                                            |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 332 | <b>Suggested UCL to Use</b>                                                                                |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 333 |                                                                                                            |   |   | 95% Student's-t UCL                         | 34.12 |                                         |   |   |   |                                                |        |
| 334 |                                                                                                            |   |   |                                             |       |                                         |   |   |   |                                                |        |
| 335 | <b>Recommended UCL exceeds the maximum observation</b>                                                     |   |   |                                             |       |                                         |   |   |   |                                                |        |

| A   | B                                                                                                                                                                                                                    | C     | D | E | F                                       | G | H | I                                                   | J      | K | L |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---|---|-----------------------------------------|---|---|-----------------------------------------------------|--------|---|---|
| 336 |                                                                                                                                                                                                                      |       |   |   |                                         |   |   |                                                     |        |   |   |
| 337 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.                                                                                         |       |   |   |                                         |   |   |                                                     |        |   |   |
| 338 | Recommendations are based upon data size, data distribution, and skewness.                                                                                                                                           |       |   |   |                                         |   |   |                                                     |        |   |   |
| 339 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                                                                                             |       |   |   |                                         |   |   |                                                     |        |   |   |
| 340 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician                                                                             |       |   |   |                                         |   |   |                                                     |        |   |   |
| 341 |                                                                                                                                                                                                                      |       |   |   |                                         |   |   |                                                     |        |   |   |
| 342 | <b>Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.</b> |       |   |   |                                         |   |   |                                                     |        |   |   |
| 343 |                                                                                                                                                                                                                      |       |   |   |                                         |   |   |                                                     |        |   |   |
| 344 |                                                                                                                                                                                                                      |       |   |   |                                         |   |   |                                                     |        |   |   |
| 345 |                                                                                                                                                                                                                      |       |   |   |                                         |   |   |                                                     |        |   |   |
| 346 | <b>Result (eu6_copper)</b>                                                                                                                                                                                           |       |   |   |                                         |   |   |                                                     |        |   |   |
| 347 |                                                                                                                                                                                                                      |       |   |   |                                         |   |   |                                                     |        |   |   |
| 348 | <b>General Statistics</b>                                                                                                                                                                                            |       |   |   |                                         |   |   |                                                     |        |   |   |
| 349 | Total Number of Observations                                                                                                                                                                                         | 4     |   |   |                                         |   |   | Number of Distinct Observations                     | 4      |   |   |
| 350 |                                                                                                                                                                                                                      |       |   |   |                                         |   |   | Number of Missing Observations                      | 0      |   |   |
| 351 | Minimum                                                                                                                                                                                                              | 11.6  |   |   |                                         |   |   | Mean                                                | 18.9   |   |   |
| 352 | Maximum                                                                                                                                                                                                              | 22    |   |   |                                         |   |   | Median                                              | 21     |   |   |
| 353 | SD                                                                                                                                                                                                                   | 4.906 |   |   |                                         |   |   | Std. Error of Mean                                  | 2.453  |   |   |
| 354 | Coefficient of Variation                                                                                                                                                                                             | 0.26  |   |   |                                         |   |   | Skewness                                            | -1.905 |   |   |
| 355 |                                                                                                                                                                                                                      |       |   |   |                                         |   |   |                                                     |        |   |   |
| 356 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>           |       |   |   |                                         |   |   |                                                     |        |   |   |
| 357 |                                                                                                                                                                                                                      |       |   |   |                                         |   |   |                                                     |        |   |   |
| 358 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                                                                                                  |       |   |   |                                         |   |   |                                                     |        |   |   |
| 359 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                                                                                                       |       |   |   |                                         |   |   |                                                     |        |   |   |
| 360 |                                                                                                                                                                                                                      |       |   |   |                                         |   |   |                                                     |        |   |   |
| 361 | <b>Normal GOF Test</b>                                                                                                                                                                                               |       |   |   |                                         |   |   |                                                     |        |   |   |
| 362 | Shapiro Wilk Test Statistic                                                                                                                                                                                          | 0.741 |   |   |                                         |   |   | <b>Shapiro Wilk GOF Test</b>                        |        |   |   |
| 363 | 5% Shapiro Wilk Critical Value                                                                                                                                                                                       | 0.748 |   |   |                                         |   |   | Data Not Normal at 5% Significance Level            |        |   |   |
| 364 | Lilliefors Test Statistic                                                                                                                                                                                            | 0.378 |   |   |                                         |   |   | <b>Lilliefors GOF Test</b>                          |        |   |   |
| 365 | 5% Lilliefors Critical Value                                                                                                                                                                                         | 0.375 |   |   |                                         |   |   | Data Not Normal at 5% Significance Level            |        |   |   |
| 366 | <b>Data Not Normal at 5% Significance Level</b>                                                                                                                                                                      |       |   |   |                                         |   |   |                                                     |        |   |   |
| 367 |                                                                                                                                                                                                                      |       |   |   |                                         |   |   |                                                     |        |   |   |
| 368 | <b>Assuming Normal Distribution</b>                                                                                                                                                                                  |       |   |   |                                         |   |   |                                                     |        |   |   |
| 369 | <b>95% Normal UCL</b>                                                                                                                                                                                                |       |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |   |                                                     |        |   |   |
| 370 | 95% Student's-t UCL                                                                                                                                                                                                  | 24.67 |   |   |                                         |   |   | 95% Adjusted-CLT UCL (Chen-1995)                    | 20.44  |   |   |
| 371 |                                                                                                                                                                                                                      |       |   |   |                                         |   |   | 95% Modified-t UCL (Johnson-1978)                   | 24.28  |   |   |
| 372 |                                                                                                                                                                                                                      |       |   |   |                                         |   |   |                                                     |        |   |   |
| 373 | <b>Gamma GOF Test</b>                                                                                                                                                                                                |       |   |   |                                         |   |   |                                                     |        |   |   |
| 374 | A-D Test Statistic                                                                                                                                                                                                   | 0.737 |   |   |                                         |   |   | <b>Anderson-Darling Gamma GOF Test</b>              |        |   |   |
| 375 | 5% A-D Critical Value                                                                                                                                                                                                | 0.657 |   |   |                                         |   |   | Data Not Gamma Distributed at 5% Significance Level |        |   |   |
| 376 | K-S Test Statistic                                                                                                                                                                                                   | 0.41  |   |   |                                         |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |        |   |   |
| 377 | 5% K-S Critical Value                                                                                                                                                                                                | 0.395 |   |   |                                         |   |   | Data Not Gamma Distributed at 5% Significance Level |        |   |   |
| 378 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                                                                                                           |       |   |   |                                         |   |   |                                                     |        |   |   |
| 379 |                                                                                                                                                                                                                      |       |   |   |                                         |   |   |                                                     |        |   |   |
| 380 | <b>Gamma Statistics</b>                                                                                                                                                                                              |       |   |   |                                         |   |   |                                                     |        |   |   |
| 381 | k hat (MLE)                                                                                                                                                                                                          | 16.02 |   |   |                                         |   |   | k star (bias corrected MLE)                         | 4.172  |   |   |
| 382 | Theta hat (MLE)                                                                                                                                                                                                      | 1.18  |   |   |                                         |   |   | Theta star (bias corrected MLE)                     | 4.53   |   |   |
| 383 | nu hat (MLE)                                                                                                                                                                                                         | 128.2 |   |   |                                         |   |   | nu star (bias corrected)                            | 33.38  |   |   |
| 384 | MLE Mean (bias corrected)                                                                                                                                                                                            | 18.9  |   |   |                                         |   |   | MLE Sd (bias corrected)                             | 9.253  |   |   |
| 385 |                                                                                                                                                                                                                      |       |   |   |                                         |   |   | Approximate Chi Square Value (0.05)                 | 21.17  |   |   |
| 386 | Adjusted Level of Significance                                                                                                                                                                                       | N/A   |   |   |                                         |   |   | Adjusted Chi Square Value                           | N/A    |   |   |
| 387 |                                                                                                                                                                                                                      |       |   |   |                                         |   |   |                                                     |        |   |   |
| 388 | <b>Assuming Gamma Distribution</b>                                                                                                                                                                                   |       |   |   |                                         |   |   |                                                     |        |   |   |
| 389 | 95% Approximate Gamma UCL (use when n>=50)                                                                                                                                                                           | 29.8  |   |   |                                         |   |   | 95% Adjusted Gamma UCL (use when n<50)              | N/A    |   |   |
| 390 |                                                                                                                                                                                                                      |       |   |   |                                         |   |   |                                                     |        |   |   |
| 391 | <b>Lognormal GOF Test</b>                                                                                                                                                                                            |       |   |   |                                         |   |   |                                                     |        |   |   |
| 392 | Shapiro Wilk Test Statistic                                                                                                                                                                                          | 0.715 |   |   |                                         |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>              |        |   |   |
| 393 | 5% Shapiro Wilk Critical Value                                                                                                                                                                                       | 0.748 |   |   |                                         |   |   | Data Not Lognormal at 5% Significance Level         |        |   |   |
| 394 | Lilliefors Test Statistic                                                                                                                                                                                            | 0.394 |   |   |                                         |   |   | <b>Lilliefors Lognormal GOF Test</b>                |        |   |   |
| 395 | 5% Lilliefors Critical Value                                                                                                                                                                                         | 0.375 |   |   |                                         |   |   | Data Not Lognormal at 5% Significance Level         |        |   |   |
| 396 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                                                                                                   |       |   |   |                                         |   |   |                                                     |        |   |   |
| 397 |                                                                                                                                                                                                                      |       |   |   |                                         |   |   |                                                     |        |   |   |
| 398 | <b>Lognormal Statistics</b>                                                                                                                                                                                          |       |   |   |                                         |   |   |                                                     |        |   |   |
| 399 | Minimum of Logged Data                                                                                                                                                                                               | 2.451 |   |   |                                         |   |   | Mean of logged Data                                 | 2.908  |   |   |
| 400 | Maximum of Logged Data                                                                                                                                                                                               | 3.091 |   |   |                                         |   |   | SD of logged Data                                   | 0.306  |   |   |
| 401 |                                                                                                                                                                                                                      |       |   |   |                                         |   |   |                                                     |        |   |   |
| 402 | <b>Assuming Lognormal Distribution</b>                                                                                                                                                                               |       |   |   |                                         |   |   |                                                     |        |   |   |

| A   | B | C | D | E | F                                                                                                                                                                                                                    | G     | H | I | J | K                                                               | L     |  |
|-----|---|---|---|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---|---|---|-----------------------------------------------------------------|-------|--|
| 403 |   |   |   |   | 95% H-UCL                                                                                                                                                                                                            | 31.45 |   |   |   | 90% Chebyshev (MVUE) UCL                                        | 27.6  |  |
| 404 |   |   |   |   | 95% Chebyshev (MVUE) UCL                                                                                                                                                                                             | 31.51 |   |   |   | 97.5% Chebyshev (MVUE) UCL                                      | 36.94 |  |
| 405 |   |   |   |   | 99% Chebyshev (MVUE) UCL                                                                                                                                                                                             | 47.61 |   |   |   |                                                                 |       |  |
| 406 |   |   |   |   |                                                                                                                                                                                                                      |       |   |   |   |                                                                 |       |  |
| 407 |   |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                                                                                                |       |   |   |   |                                                                 |       |  |
| 408 |   |   |   |   | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                                                                                                          |       |   |   |   |                                                                 |       |  |
| 409 |   |   |   |   |                                                                                                                                                                                                                      |       |   |   |   |                                                                 |       |  |
| 410 |   |   |   |   | <b>Nonparametric Distribution Free UCLs</b>                                                                                                                                                                          |       |   |   |   |                                                                 |       |  |
| 411 |   |   |   |   | 95% CLT UCL                                                                                                                                                                                                          | 22.94 |   |   |   | 95% Jackknife UCL                                               | 24.67 |  |
| 412 |   |   |   |   | 95% Standard Bootstrap UCL                                                                                                                                                                                           | N/A   |   |   |   | 95% Bootstrap-t UCL                                             | N/A   |  |
| 413 |   |   |   |   | 95% Hall's Bootstrap UCL                                                                                                                                                                                             | N/A   |   |   |   | 95% Percentile Bootstrap UCL                                    | N/A   |  |
| 414 |   |   |   |   | 95% BCA Bootstrap UCL                                                                                                                                                                                                | N/A   |   |   |   |                                                                 |       |  |
| 415 |   |   |   |   | 90% Chebyshev(Mean, Sd) UCL                                                                                                                                                                                          | 26.26 |   |   |   | 95% Chebyshev(Mean, Sd) UCL                                     | 29.59 |  |
| 416 |   |   |   |   | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                                                                                                        | 34.22 |   |   |   | 99% Chebyshev(Mean, Sd) UCL                                     | 43.31 |  |
| 417 |   |   |   |   |                                                                                                                                                                                                                      |       |   |   |   |                                                                 |       |  |
| 418 |   |   |   |   | <b>Suggested UCL to Use</b>                                                                                                                                                                                          |       |   |   |   |                                                                 |       |  |
| 419 |   |   |   |   | 95% Student's-t UCL                                                                                                                                                                                                  | 24.67 |   |   |   | or 95% Modified-t UCL                                           | 24.28 |  |
| 420 |   |   |   |   |                                                                                                                                                                                                                      |       |   |   |   |                                                                 |       |  |
| 421 |   |   |   |   | <b>Recommended UCL exceeds the maximum observation</b>                                                                                                                                                               |       |   |   |   |                                                                 |       |  |
| 422 |   |   |   |   |                                                                                                                                                                                                                      |       |   |   |   |                                                                 |       |  |
| 423 |   |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.                                                                                         |       |   |   |   |                                                                 |       |  |
| 424 |   |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                                                                                                           |       |   |   |   |                                                                 |       |  |
| 425 |   |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                                                                                             |       |   |   |   |                                                                 |       |  |
| 426 |   |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician                                                                             |       |   |   |   |                                                                 |       |  |
| 427 |   |   |   |   |                                                                                                                                                                                                                      |       |   |   |   |                                                                 |       |  |
| 428 |   |   |   |   | <b>Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.</b> |       |   |   |   |                                                                 |       |  |
| 429 |   |   |   |   |                                                                                                                                                                                                                      |       |   |   |   |                                                                 |       |  |
| 430 |   |   |   |   |                                                                                                                                                                                                                      |       |   |   |   |                                                                 |       |  |
| 431 |   |   |   |   |                                                                                                                                                                                                                      |       |   |   |   |                                                                 |       |  |
| 432 |   |   |   |   | <b>Result (eu6_iron)</b>                                                                                                                                                                                             |       |   |   |   |                                                                 |       |  |
| 433 |   |   |   |   |                                                                                                                                                                                                                      |       |   |   |   |                                                                 |       |  |
| 434 |   |   |   |   | <b>General Statistics</b>                                                                                                                                                                                            |       |   |   |   |                                                                 |       |  |
| 435 |   |   |   |   | Total Number of Observations                                                                                                                                                                                         | 4     |   |   |   | Number of Distinct Observations                                 | 4     |  |
| 436 |   |   |   |   |                                                                                                                                                                                                                      |       |   |   |   | Number of Missing Observations                                  | 0     |  |
| 437 |   |   |   |   | Minimum                                                                                                                                                                                                              | 13700 |   |   |   | Mean                                                            | 23200 |  |
| 438 |   |   |   |   | Maximum                                                                                                                                                                                                              | 33100 |   |   |   | Median                                                          | 23000 |  |
| 439 |   |   |   |   | SD                                                                                                                                                                                                                   | 8343  |   |   |   | Std. Error of Mean                                              | 4172  |  |
| 440 |   |   |   |   | Coefficient of Variation                                                                                                                                                                                             | 0.36  |   |   |   | Skewness                                                        | 0.116 |  |
| 441 |   |   |   |   |                                                                                                                                                                                                                      |       |   |   |   |                                                                 |       |  |
| 442 |   |   |   |   | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>           |       |   |   |   |                                                                 |       |  |
| 443 |   |   |   |   | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                                                                                                  |       |   |   |   |                                                                 |       |  |
| 444 |   |   |   |   | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                                                                                                       |       |   |   |   |                                                                 |       |  |
| 445 |   |   |   |   |                                                                                                                                                                                                                      |       |   |   |   |                                                                 |       |  |
| 446 |   |   |   |   |                                                                                                                                                                                                                      |       |   |   |   |                                                                 |       |  |
| 447 |   |   |   |   | <b>Normal GOF Test</b>                                                                                                                                                                                               |       |   |   |   |                                                                 |       |  |
| 448 |   |   |   |   | Shapiro Wilk Test Statistic                                                                                                                                                                                          | 0.994 |   |   |   | <b>Shapiro Wilk GOF Test</b>                                    |       |  |
| 449 |   |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                                                                                                       | 0.748 |   |   |   | Data appear Normal at 5% Significance Level                     |       |  |
| 450 |   |   |   |   | Lilliefors Test Statistic                                                                                                                                                                                            | 0.158 |   |   |   | <b>Lilliefors GOF Test</b>                                      |       |  |
| 451 |   |   |   |   | 5% Lilliefors Critical Value                                                                                                                                                                                         | 0.375 |   |   |   | Data appear Normal at 5% Significance Level                     |       |  |
| 452 |   |   |   |   | <b>Data appear Normal at 5% Significance Level</b>                                                                                                                                                                   |       |   |   |   |                                                                 |       |  |
| 453 |   |   |   |   |                                                                                                                                                                                                                      |       |   |   |   |                                                                 |       |  |
| 454 |   |   |   |   | <b>Assuming Normal Distribution</b>                                                                                                                                                                                  |       |   |   |   |                                                                 |       |  |
| 455 |   |   |   |   | <b>95% Normal UCL</b>                                                                                                                                                                                                |       |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b>                         |       |  |
| 456 |   |   |   |   | 95% Student's-t UCL                                                                                                                                                                                                  | 33017 |   |   |   | 95% Adjusted-CLT UCL (Chen-1995)                                | 30319 |  |
| 457 |   |   |   |   |                                                                                                                                                                                                                      |       |   |   |   | 95% Modified-t UCL (Johnson-1978)                               | 33057 |  |
| 458 |   |   |   |   |                                                                                                                                                                                                                      |       |   |   |   |                                                                 |       |  |
| 459 |   |   |   |   | <b>Gamma GOF Test</b>                                                                                                                                                                                                |       |   |   |   |                                                                 |       |  |
| 460 |   |   |   |   | A-D Test Statistic                                                                                                                                                                                                   | 0.204 |   |   |   | <b>Anderson-Darling Gamma GOF Test</b>                          |       |  |
| 461 |   |   |   |   | 5% A-D Critical Value                                                                                                                                                                                                | 0.657 |   |   |   | Detected data appear Gamma Distributed at 5% Significance Level |       |  |
| 462 |   |   |   |   | K-S Test Statistic                                                                                                                                                                                                   | 0.189 |   |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |       |  |
| 463 |   |   |   |   | 5% K-S Critical Value                                                                                                                                                                                                | 0.395 |   |   |   | Detected data appear Gamma Distributed at 5% Significance Level |       |  |
| 464 |   |   |   |   | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                                                                                               |       |   |   |   |                                                                 |       |  |
| 465 |   |   |   |   |                                                                                                                                                                                                                      |       |   |   |   |                                                                 |       |  |
| 466 |   |   |   |   | <b>Gamma Statistics</b>                                                                                                                                                                                              |       |   |   |   |                                                                 |       |  |
| 467 |   |   |   |   | k hat (MLE)                                                                                                                                                                                                          | 9.768 |   |   |   | k star (bias corrected MLE)                                     | 2.609 |  |
| 468 |   |   |   |   | Theta hat (MLE)                                                                                                                                                                                                      | 2375  |   |   |   | Theta star (bias corrected MLE)                                 | 8893  |  |
| 469 |   |   |   |   | nu hat (MLE)                                                                                                                                                                                                         | 78.14 |   |   |   | nu star (bias corrected)                                        | 20.87 |  |

| A   | B                                                                                                                                        | C | D | E | F                                   | G                                              | H | I | J     | K     | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|-------------------------------------|------------------------------------------------|---|---|-------|-------|---|
| 470 | MLE Mean (bias corrected)                                                                                                                |   |   |   | 23200                               | MLE Sd (bias corrected)                        |   |   |       | 14364 |   |
| 471 |                                                                                                                                          |   |   |   | Approximate Chi Square Value (0.05) |                                                |   |   | 11.49 |       |   |
| 472 | Adjusted Level of Significance                                                                                                           |   |   |   | N/A                                 | Adjusted Chi Square Value                      |   |   |       | N/A   |   |
| 473 |                                                                                                                                          |   |   |   |                                     |                                                |   |   |       |       |   |
| 474 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |   |                                     |                                                |   |   |       |       |   |
| 475 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   |   |   | 42122                               | 95% Adjusted Gamma UCL (use when n<50)         |   |   |       | N/A   |   |
| 476 |                                                                                                                                          |   |   |   |                                     |                                                |   |   |       |       |   |
| 477 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |   |                                     |                                                |   |   |       |       |   |
| 478 | Shapiro Wilk Test Statistic                                                                                                              |   |   |   | 0.986                               | <b>Shapiro Wilk Lognormal GOF Test</b>         |   |   |       |       |   |
| 479 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   |   | 0.748                               | Data appear Lognormal at 5% Significance Level |   |   |       |       |   |
| 480 | Lilliefors Test Statistic                                                                                                                |   |   |   | 0.176                               | <b>Lilliefors Lognormal GOF Test</b>           |   |   |       |       |   |
| 481 | 5% Lilliefors Critical Value                                                                                                             |   |   |   | 0.375                               | Data appear Lognormal at 5% Significance Level |   |   |       |       |   |
| 482 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |   |                                     |                                                |   |   |       |       |   |
| 483 |                                                                                                                                          |   |   |   |                                     |                                                |   |   |       |       |   |
| 484 | <b>Lognormal Statistics</b>                                                                                                              |   |   |   |                                     |                                                |   |   |       |       |   |
| 485 | Minimum of Logged Data                                                                                                                   |   |   |   | 9.525                               | Mean of logged Data                            |   |   |       | 10    |   |
| 486 | Maximum of Logged Data                                                                                                                   |   |   |   | 10.41                               | SD of logged Data                              |   |   |       | 0.38  |   |
| 487 |                                                                                                                                          |   |   |   |                                     |                                                |   |   |       |       |   |
| 488 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |   |                                     |                                                |   |   |       |       |   |
| 489 | 95% H-UCL                                                                                                                                |   |   |   | 46592                               | 90% Chebyshev (MVUE) UCL                       |   |   |       | 36329 |   |
| 490 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   |   | 42261                               | 97.5% Chebyshev (MVUE) UCL                     |   |   |       | 50494 |   |
| 491 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   |   | 66666                               |                                                |   |   |       |       |   |
| 492 |                                                                                                                                          |   |   |   |                                     |                                                |   |   |       |       |   |
| 493 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |   |                                     |                                                |   |   |       |       |   |
| 494 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |   |                                     |                                                |   |   |       |       |   |
| 495 |                                                                                                                                          |   |   |   |                                     |                                                |   |   |       |       |   |
| 496 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |   |                                     |                                                |   |   |       |       |   |
| 497 | 95% CLT UCL                                                                                                                              |   |   |   | 30062                               | 95% Jackknife UCL                              |   |   |       | 33017 |   |
| 498 | 95% Standard Bootstrap UCL                                                                                                               |   |   |   | N/A                                 | 95% Bootstrap-t UCL                            |   |   |       | N/A   |   |
| 499 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   |   | N/A                                 | 95% Percentile Bootstrap UCL                   |   |   |       | N/A   |   |
| 500 | 95% BCA Bootstrap UCL                                                                                                                    |   |   |   | N/A                                 |                                                |   |   |       |       |   |
| 501 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   |   | 35715                               | 95% Chebyshev(Mean, Sd) UCL                    |   |   |       | 41383 |   |
| 502 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   |   | 49251                               | 99% Chebyshev(Mean, Sd) UCL                    |   |   |       | 64706 |   |
| 503 |                                                                                                                                          |   |   |   |                                     |                                                |   |   |       |       |   |
| 504 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |   |                                     |                                                |   |   |       |       |   |
| 505 | 95% Student's-t UCL                                                                                                                      |   |   |   | 33017                               |                                                |   |   |       |       |   |
| 506 |                                                                                                                                          |   |   |   |                                     |                                                |   |   |       |       |   |
| 507 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |   |                                     |                                                |   |   |       |       |   |
| 508 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |   |                                     |                                                |   |   |       |       |   |
| 509 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |   |                                     |                                                |   |   |       |       |   |
| 510 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |   |                                     |                                                |   |   |       |       |   |
| 511 |                                                                                                                                          |   |   |   |                                     |                                                |   |   |       |       |   |
| 512 |                                                                                                                                          |   |   |   |                                     |                                                |   |   |       |       |   |
| 513 | <b>Result (eu6_lead)</b>                                                                                                                 |   |   |   |                                     |                                                |   |   |       |       |   |
| 514 |                                                                                                                                          |   |   |   |                                     |                                                |   |   |       |       |   |
| 515 | <b>General Statistics</b>                                                                                                                |   |   |   |                                     |                                                |   |   |       |       |   |
| 516 | Total Number of Observations                                                                                                             |   |   |   | 4                                   | Number of Distinct Observations                |   |   |       | 4     |   |
| 517 |                                                                                                                                          |   |   |   |                                     | Number of Missing Observations                 |   |   |       | 0     |   |
| 518 | Minimum                                                                                                                                  |   |   |   | 222                                 | Mean                                           |   |   |       | 287   |   |
| 519 | Maximum                                                                                                                                  |   |   |   | 420                                 | Median                                         |   |   |       | 253   |   |
| 520 | SD                                                                                                                                       |   |   |   | 90.81                               | Std. Error of Mean                             |   |   |       | 45.4  |   |
| 521 | Coefficient of Variation                                                                                                                 |   |   |   | 0.316                               | Skewness                                       |   |   |       | 1.734 |   |
| 522 |                                                                                                                                          |   |   |   |                                     |                                                |   |   |       |       |   |
| 523 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |   |   |   |                                     |                                                |   |   |       |       |   |
| 524 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |   |   |   |                                     |                                                |   |   |       |       |   |
| 525 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |   |   |   |                                     |                                                |   |   |       |       |   |
| 526 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |   |   |   |                                     |                                                |   |   |       |       |   |
| 527 |                                                                                                                                          |   |   |   |                                     |                                                |   |   |       |       |   |
| 528 | <b>Normal GOF Test</b>                                                                                                                   |   |   |   |                                     |                                                |   |   |       |       |   |
| 529 | Shapiro Wilk Test Statistic                                                                                                              |   |   |   | 0.809                               | <b>Shapiro Wilk GOF Test</b>                   |   |   |       |       |   |
| 530 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   |   | 0.748                               | Data appear Normal at 5% Significance Level    |   |   |       |       |   |
| 531 | Lilliefors Test Statistic                                                                                                                |   |   |   | 0.329                               | <b>Lilliefors GOF Test</b>                     |   |   |       |       |   |
| 532 | 5% Lilliefors Critical Value                                                                                                             |   |   |   | 0.375                               | Data appear Normal at 5% Significance Level    |   |   |       |       |   |
| 533 | <b>Data appear Normal at 5% Significance Level</b>                                                                                       |   |   |   |                                     |                                                |   |   |       |       |   |
| 534 |                                                                                                                                          |   |   |   |                                     |                                                |   |   |       |       |   |
| 535 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |   |                                     |                                                |   |   |       |       |   |
| 536 | <b>95% Normal UCL</b>                                                                                                                    |   |   |   |                                     | <b>95% UCLs (Adjusted for Skewness)</b>        |   |   |       |       |   |



| A   | B                                                                                                          | C     | D                                                               | E | F                                       | G | H | I | J     | K | L |
|-----|------------------------------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------|---|-----------------------------------------|---|---|---|-------|---|---|
| 604 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b> |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 605 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>     |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 606 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                        |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 607 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>             |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 608 |                                                                                                            |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 609 | <b>Normal GOF Test</b>                                                                                     |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 610 | Shapiro Wilk Test Statistic                                                                                | 0.914 | <b>Shapiro Wilk GOF Test</b>                                    |   |                                         |   |   |   |       |   |   |
| 611 | 5% Shapiro Wilk Critical Value                                                                             | 0.748 | Data appear Normal at 5% Significance Level                     |   |                                         |   |   |   |       |   |   |
| 612 | Lilliefors Test Statistic                                                                                  | 0.274 | <b>Lilliefors GOF Test</b>                                      |   |                                         |   |   |   |       |   |   |
| 613 | 5% Lilliefors Critical Value                                                                               | 0.375 | Data appear Normal at 5% Significance Level                     |   |                                         |   |   |   |       |   |   |
| 614 | <b>Data appear Normal at 5% Significance Level</b>                                                         |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 615 |                                                                                                            |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 616 | <b>Assuming Normal Distribution</b>                                                                        |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 617 | <b>95% Normal UCL</b>                                                                                      |       |                                                                 |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |   |   |       |   |   |
| 618 | 95% Student's-t UCL                                                                                        | 2879  | 95% Adjusted-CLT UCL (Chen-1995)                                |   |                                         |   |   |   | 2617  |   |   |
| 619 |                                                                                                            |       | 95% Modified-t UCL (Johnson-1978)                               |   |                                         |   |   |   | 2859  |   |   |
| 620 |                                                                                                            |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 621 | <b>Gamma GOF Test</b>                                                                                      |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 622 | A-D Test Statistic                                                                                         | 0.384 | <b>Anderson-Darling Gamma GOF Test</b>                          |   |                                         |   |   |   |       |   |   |
| 623 | 5% A-D Critical Value                                                                                      | 0.656 | Detected data appear Gamma Distributed at 5% Significance Level |   |                                         |   |   |   |       |   |   |
| 624 | K-S Test Statistic                                                                                         | 0.295 | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |                                         |   |   |   |       |   |   |
| 625 | 5% K-S Critical Value                                                                                      | 0.394 | Detected data appear Gamma Distributed at 5% Significance Level |   |                                         |   |   |   |       |   |   |
| 626 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                     |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 627 |                                                                                                            |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 628 | <b>Gamma Statistics</b>                                                                                    |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 629 | k hat (MLE)                                                                                                | 51.89 | k star (bias corrected MLE)                                     |   |                                         |   |   |   | 13.14 |   |   |
| 630 | Theta hat (MLE)                                                                                            | 46.97 | Theta star (bias corrected MLE)                                 |   |                                         |   |   |   | 185.5 |   |   |
| 631 | nu hat (MLE)                                                                                               | 415.1 | nu star (bias corrected)                                        |   |                                         |   |   |   | 105.1 |   |   |
| 632 | MLE Mean (bias corrected)                                                                                  | 2438  | MLE Sd (bias corrected)                                         |   |                                         |   |   |   | 672.4 |   |   |
| 633 |                                                                                                            |       | Approximate Chi Square Value (0.05)                             |   |                                         |   |   |   | 82.46 |   |   |
| 634 | Adjusted Level of Significance                                                                             | N/A   | Adjusted Chi Square Value                                       |   |                                         |   |   |   | N/A   |   |   |
| 635 |                                                                                                            |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 636 | <b>Assuming Gamma Distribution</b>                                                                         |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 637 | 95% Approximate Gamma UCL (use when n>=50)                                                                 | 3107  | 95% Adjusted Gamma UCL (use when n<50)                          |   |                                         |   |   |   | N/A   |   |   |
| 638 |                                                                                                            |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 639 | <b>Lognormal GOF Test</b>                                                                                  |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 640 | Shapiro Wilk Test Statistic                                                                                | 0.886 | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |                                         |   |   |   |       |   |   |
| 641 | 5% Shapiro Wilk Critical Value                                                                             | 0.748 | Data appear Lognormal at 5% Significance Level                  |   |                                         |   |   |   |       |   |   |
| 642 | Lilliefors Test Statistic                                                                                  | 0.296 | <b>Lilliefors Lognormal GOF Test</b>                            |   |                                         |   |   |   |       |   |   |
| 643 | 5% Lilliefors Critical Value                                                                               | 0.375 | Data appear Lognormal at 5% Significance Level                  |   |                                         |   |   |   |       |   |   |
| 644 | <b>Data appear Lognormal at 5% Significance Level</b>                                                      |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 645 |                                                                                                            |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 646 | <b>Lognormal Statistics</b>                                                                                |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 647 | Minimum of Logged Data                                                                                     | 7.555 | Mean of logged Data                                             |   |                                         |   |   |   | 7.789 |   |   |
| 648 | Maximum of Logged Data                                                                                     | 7.93  | SD of logged Data                                               |   |                                         |   |   |   | 0.164 |   |   |
| 649 |                                                                                                            |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 650 | <b>Assuming Lognormal Distribution</b>                                                                     |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 651 | 95% H-UCL                                                                                                  | 3061  | 90% Chebyshev (MVUE) UCL                                        |   |                                         |   |   |   | 3037  |   |   |
| 652 | 95% Chebyshev (MVUE) UCL                                                                                   | 3308  | 97.5% Chebyshev (MVUE) UCL                                      |   |                                         |   |   |   | 3684  |   |   |
| 653 | 99% Chebyshev (MVUE) UCL                                                                                   | 4423  |                                                                 |   |                                         |   |   |   |       |   |   |
| 654 |                                                                                                            |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 655 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                      |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 656 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                           |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 657 |                                                                                                            |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 658 | <b>Nonparametric Distribution Free UCLs</b>                                                                |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 659 | 95% CLT UCL                                                                                                | 2746  | 95% Jackknife UCL                                               |   |                                         |   |   |   | 2879  |   |   |
| 660 | 95% Standard Bootstrap UCL                                                                                 | N/A   | 95% Bootstrap-t UCL                                             |   |                                         |   |   |   | N/A   |   |   |
| 661 | 95% Hall's Bootstrap UCL                                                                                   | N/A   | 95% Percentile Bootstrap UCL                                    |   |                                         |   |   |   | N/A   |   |   |
| 662 | 95% BCA Bootstrap UCL                                                                                      | N/A   |                                                                 |   |                                         |   |   |   |       |   |   |
| 663 | 90% Chebyshev(Mean, Sd) UCL                                                                                | 3000  | 95% Chebyshev(Mean, Sd) UCL                                     |   |                                         |   |   |   | 3255  |   |   |
| 664 | 97.5% Chebyshev(Mean, Sd) UCL                                                                              | 3609  | 99% Chebyshev(Mean, Sd) UCL                                     |   |                                         |   |   |   | 4304  |   |   |
| 665 |                                                                                                            |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 666 | <b>Suggested UCL to Use</b>                                                                                |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 667 | 95% Student's-t UCL                                                                                        | 2879  |                                                                 |   |                                         |   |   |   |       |   |   |
| 668 |                                                                                                            |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 669 | <b>Recommended UCL exceeds the maximum observation</b>                                                     |       |                                                                 |   |                                         |   |   |   |       |   |   |
| 670 |                                                                                                            |       |                                                                 |   |                                         |   |   |   |       |   |   |

| A   | B                                                                                                                                      | C     | D                                                             | E                                       | F     | G | H | I | J | K | L |
|-----|----------------------------------------------------------------------------------------------------------------------------------------|-------|---------------------------------------------------------------|-----------------------------------------|-------|---|---|---|---|---|---|
| 671 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.           |       |                                                               |                                         |       |   |   |   |   |   |   |
| 672 | Recommendations are based upon data size, data distribution, and skewness.                                                             |       |                                                               |                                         |       |   |   |   |   |   |   |
| 673 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).               |       |                                                               |                                         |       |   |   |   |   |   |   |
| 674 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistica |       |                                                               |                                         |       |   |   |   |   |   |   |
| 675 |                                                                                                                                        |       |                                                               |                                         |       |   |   |   |   |   |   |
| 676 | <b>Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be</b>               |       |                                                               |                                         |       |   |   |   |   |   |   |
| 677 | <b>reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.</b>                                     |       |                                                               |                                         |       |   |   |   |   |   |   |
| 678 |                                                                                                                                        |       |                                                               |                                         |       |   |   |   |   |   |   |
| 679 | <b>Result (eu6_thallium)</b>                                                                                                           |       |                                                               |                                         |       |   |   |   |   |   |   |
| 680 |                                                                                                                                        |       |                                                               |                                         |       |   |   |   |   |   |   |
| 681 | <b>General Statistics</b>                                                                                                              |       |                                                               |                                         |       |   |   |   |   |   |   |
| 682 | Total Number of Observations                                                                                                           | 4     | Number of Distinct Observations                               |                                         | 4     |   |   |   |   |   |   |
| 683 | Number of Detects                                                                                                                      | 0     | Number of Non-Detects                                         |                                         | 4     |   |   |   |   |   |   |
| 684 | Number of Distinct Detects                                                                                                             | 0     | Number of Distinct Non-Detects                                |                                         | 4     |   |   |   |   |   |   |
| 685 |                                                                                                                                        |       |                                                               |                                         |       |   |   |   |   |   |   |
| 686 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                     |       |                                                               |                                         |       |   |   |   |   |   |   |
| 687 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>               |       |                                                               |                                         |       |   |   |   |   |   |   |
| 688 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>      |       |                                                               |                                         |       |   |   |   |   |   |   |
| 689 |                                                                                                                                        |       |                                                               |                                         |       |   |   |   |   |   |   |
| 690 | <b>The data set for variable Result (eu6_thallium) was not processed!</b>                                                              |       |                                                               |                                         |       |   |   |   |   |   |   |
| 691 |                                                                                                                                        |       |                                                               |                                         |       |   |   |   |   |   |   |
| 692 |                                                                                                                                        |       |                                                               |                                         |       |   |   |   |   |   |   |
| 693 |                                                                                                                                        |       |                                                               |                                         |       |   |   |   |   |   |   |
| 694 | <b>Result (eu6_zinc)</b>                                                                                                               |       |                                                               |                                         |       |   |   |   |   |   |   |
| 695 |                                                                                                                                        |       |                                                               |                                         |       |   |   |   |   |   |   |
| 696 | <b>General Statistics</b>                                                                                                              |       |                                                               |                                         |       |   |   |   |   |   |   |
| 697 | Total Number of Observations                                                                                                           | 4     | Number of Distinct Observations                               |                                         | 4     |   |   |   |   |   |   |
| 698 |                                                                                                                                        |       | Number of Missing Observations                                |                                         | 0     |   |   |   |   |   |   |
| 699 | Minimum                                                                                                                                | 422   | Mean                                                          |                                         | 713   |   |   |   |   |   |   |
| 700 | Maximum                                                                                                                                | 1030  | Median                                                        |                                         | 700   |   |   |   |   |   |   |
| 701 | SD                                                                                                                                     | 258.4 | Std. Error of Mean                                            |                                         | 129.2 |   |   |   |   |   |   |
| 702 | Coefficient of Variation                                                                                                               | 0.362 | Skewness                                                      |                                         | 0.256 |   |   |   |   |   |   |
| 703 |                                                                                                                                        |       |                                                               |                                         |       |   |   |   |   |   |   |
| 704 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                             |       |                                                               |                                         |       |   |   |   |   |   |   |
| 705 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                 |       |                                                               |                                         |       |   |   |   |   |   |   |
| 706 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                    |       |                                                               |                                         |       |   |   |   |   |   |   |
| 707 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                         |       |                                                               |                                         |       |   |   |   |   |   |   |
| 708 |                                                                                                                                        |       |                                                               |                                         |       |   |   |   |   |   |   |
| 709 | <b>Normal GOF Test</b>                                                                                                                 |       |                                                               |                                         |       |   |   |   |   |   |   |
| 710 | Shapiro Wilk Test Statistic                                                                                                            | 0.996 | <b>Shapiro Wilk GOF Test</b>                                  |                                         |       |   |   |   |   |   |   |
| 711 | 5% Shapiro Wilk Critical Value                                                                                                         | 0.748 | Data appear Normal at 5% Significance Level                   |                                         |       |   |   |   |   |   |   |
| 712 | Lilliefors Test Statistic                                                                                                              | 0.149 | <b>Lilliefors GOF Test</b>                                    |                                         |       |   |   |   |   |   |   |
| 713 | 5% Lilliefors Critical Value                                                                                                           | 0.375 | Data appear Normal at 5% Significance Level                   |                                         |       |   |   |   |   |   |   |
| 714 | <b>Data appear Normal at 5% Significance Level</b>                                                                                     |       |                                                               |                                         |       |   |   |   |   |   |   |
| 715 |                                                                                                                                        |       |                                                               |                                         |       |   |   |   |   |   |   |
| 716 | <b>Assuming Normal Distribution</b>                                                                                                    |       |                                                               |                                         |       |   |   |   |   |   |   |
| 717 | <b>95% Normal UCL</b>                                                                                                                  |       |                                                               | <b>95% UCLs (Adjusted for Skewness)</b> |       |   |   |   |   |   |   |
| 718 | 95% Student's-t UCL                                                                                                                    | 1017  | 95% Adjusted-CLT UCL (Chen-1995)                              |                                         | 943.2 |   |   |   |   |   |   |
| 719 |                                                                                                                                        |       | 95% Modified-t UCL (Johnson-1978)                             |                                         | 1020  |   |   |   |   |   |   |
| 720 |                                                                                                                                        |       |                                                               |                                         |       |   |   |   |   |   |   |
| 721 | <b>Gamma GOF Test</b>                                                                                                                  |       |                                                               |                                         |       |   |   |   |   |   |   |
| 722 | A-D Test Statistic                                                                                                                     | 0.193 | <b>Anderson-Darling Gamma GOF Test</b>                        |                                         |       |   |   |   |   |   |   |
| 723 | 5% A-D Critical Value                                                                                                                  | 0.657 | detected data appear Gamma Distributed at 5% Significance Lev |                                         |       |   |   |   |   |   |   |
| 724 | K-S Test Statistic                                                                                                                     | 0.168 | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                      |                                         |       |   |   |   |   |   |   |
| 725 | 5% K-S Critical Value                                                                                                                  | 0.395 | detected data appear Gamma Distributed at 5% Significance Lev |                                         |       |   |   |   |   |   |   |
| 726 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                 |       |                                                               |                                         |       |   |   |   |   |   |   |
| 727 |                                                                                                                                        |       |                                                               |                                         |       |   |   |   |   |   |   |
| 728 | <b>Gamma Statistics</b>                                                                                                                |       |                                                               |                                         |       |   |   |   |   |   |   |
| 729 | k hat (MLE)                                                                                                                            | 9.749 | k star (bias corrected MLE)                                   |                                         | 2.604 |   |   |   |   |   |   |
| 730 | Theta hat (MLE)                                                                                                                        | 73.14 | Theta star (bias corrected MLE)                               |                                         | 273.8 |   |   |   |   |   |   |
| 731 | nu hat (MLE)                                                                                                                           | 77.99 | nu star (bias corrected)                                      |                                         | 20.83 |   |   |   |   |   |   |
| 732 | MLE Mean (bias corrected)                                                                                                              | 713   | MLE Sd (bias corrected)                                       |                                         | 441.9 |   |   |   |   |   |   |
| 733 |                                                                                                                                        |       | Approximate Chi Square Value (0.05)                           |                                         | 11.47 |   |   |   |   |   |   |
| 734 | Adjusted Level of Significance                                                                                                         | N/A   | Adjusted Chi Square Value                                     |                                         | N/A   |   |   |   |   |   |   |
| 735 |                                                                                                                                        |       |                                                               |                                         |       |   |   |   |   |   |   |
| 736 | <b>Assuming Gamma Distribution</b>                                                                                                     |       |                                                               |                                         |       |   |   |   |   |   |   |
| 737 | 95% Approximate Gamma UCL (use when n>=50)                                                                                             | 1295  | 95% Adjusted Gamma UCL (use when n<50)                        |                                         | N/A   |   |   |   |   |   |   |

| A   | B                                                                                                                                        | C     | D                                                               | E | F | G                                       | H | I | J                                 | K     | L |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------|---|---|-----------------------------------------|---|---|-----------------------------------|-------|---|
| 738 |                                                                                                                                          |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 739 | <b>Lognormal GOF Test</b>                                                                                                                |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 740 | Shapiro Wilk Test Statistic                                                                                                              | 0.993 | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |                                         |   |   |                                   |       |   |
| 741 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.748 | Data appear Lognormal at 5% Significance Level                  |   |   |                                         |   |   |                                   |       |   |
| 742 | Lilliefors Test Statistic                                                                                                                | 0.153 | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |                                         |   |   |                                   |       |   |
| 743 | 5% Lilliefors Critical Value                                                                                                             | 0.375 | Data appear Lognormal at 5% Significance Level                  |   |   |                                         |   |   |                                   |       |   |
| 744 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 745 |                                                                                                                                          |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 746 | <b>Lognormal Statistics</b>                                                                                                              |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 747 | Minimum of Logged Data                                                                                                                   | 6.045 |                                                                 |   |   |                                         |   |   | Mean of logged Data               | 6.517 |   |
| 748 | Maximum of Logged Data                                                                                                                   | 6.937 |                                                                 |   |   |                                         |   |   | SD of logged Data                 | 0.379 |   |
| 749 |                                                                                                                                          |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 750 | <b>Assuming Lognormal Distribution</b>                                                                                                   |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 751 | 95% H-UCL                                                                                                                                | 1429  |                                                                 |   |   |                                         |   |   | 90% Chebyshev (MVUE) UCL          | 1116  |   |
| 752 | 95% Chebyshev (MVUE) UCL                                                                                                                 | 1297  |                                                                 |   |   |                                         |   |   | 97.5% Chebyshev (MVUE) UCL        | 1550  |   |
| 753 | 99% Chebyshev (MVUE) UCL                                                                                                                 | 2046  |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 754 |                                                                                                                                          |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 755 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 756 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 757 |                                                                                                                                          |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 758 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 759 | 95% CLT UCL                                                                                                                              | 925.5 |                                                                 |   |   |                                         |   |   | 95% Jackknife UCL                 | 1017  |   |
| 760 | 95% Standard Bootstrap UCL                                                                                                               | N/A   |                                                                 |   |   |                                         |   |   | 95% Bootstrap-t UCL               | N/A   |   |
| 761 | 95% Hall's Bootstrap UCL                                                                                                                 | N/A   |                                                                 |   |   |                                         |   |   | 95% Percentile Bootstrap UCL      | N/A   |   |
| 762 | 95% BCA Bootstrap UCL                                                                                                                    | N/A   |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 763 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              | 1101  |                                                                 |   |   |                                         |   |   | 95% Chebyshev(Mean, Sd) UCL       | 1276  |   |
| 764 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            | 1520  |                                                                 |   |   |                                         |   |   | 99% Chebyshev(Mean, Sd) UCL       | 1998  |   |
| 765 |                                                                                                                                          |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 766 | <b>Suggested UCL to Use</b>                                                                                                              |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 767 | 95% Student's-t UCL                                                                                                                      | 1017  |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 768 |                                                                                                                                          |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 769 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 770 | Recommendations are based upon data size, data distribution, and skewness.                                                               |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 771 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 772 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 773 |                                                                                                                                          |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 774 |                                                                                                                                          |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 775 | <b>Result (eu7_arsenic)</b>                                                                                                              |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 776 |                                                                                                                                          |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 777 | <b>General Statistics</b>                                                                                                                |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 778 | Total Number of Observations                                                                                                             | 39    |                                                                 |   |   |                                         |   |   | Number of Distinct Observations   | 37    |   |
| 779 |                                                                                                                                          |       |                                                                 |   |   |                                         |   |   | Number of Missing Observations    | 0     |   |
| 780 | Minimum                                                                                                                                  | 5.1   |                                                                 |   |   |                                         |   |   | Mean                              | 26.07 |   |
| 781 | Maximum                                                                                                                                  | 83    |                                                                 |   |   |                                         |   |   | Median                            | 19.8  |   |
| 782 | SD                                                                                                                                       | 19.5  |                                                                 |   |   |                                         |   |   | Std. Error of Mean                | 3.123 |   |
| 783 | Coefficient of Variation                                                                                                                 | 0.748 |                                                                 |   |   |                                         |   |   | Skewness                          | 1.18  |   |
| 784 |                                                                                                                                          |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 785 | <b>Normal GOF Test</b>                                                                                                                   |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 786 | Shapiro Wilk Test Statistic                                                                                                              | 0.869 | <b>Shapiro Wilk GOF Test</b>                                    |   |   |                                         |   |   |                                   |       |   |
| 787 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.939 | Data Not Normal at 5% Significance Level                        |   |   |                                         |   |   |                                   |       |   |
| 788 | Lilliefors Test Statistic                                                                                                                | 0.186 | <b>Lilliefors GOF Test</b>                                      |   |   |                                         |   |   |                                   |       |   |
| 789 | 5% Lilliefors Critical Value                                                                                                             | 0.14  | Data Not Normal at 5% Significance Level                        |   |   |                                         |   |   |                                   |       |   |
| 790 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 791 |                                                                                                                                          |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 792 | <b>Assuming Normal Distribution</b>                                                                                                      |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 793 | <b>95% Normal UCL</b>                                                                                                                    |       |                                                                 |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |   |                                   |       |   |
| 794 | 95% Student's-t UCL                                                                                                                      | 31.34 |                                                                 |   |   |                                         |   |   | 95% Adjusted-CLT UCL (Chen-1995)  | 31.84 |   |
| 795 |                                                                                                                                          |       |                                                                 |   |   |                                         |   |   | 95% Modified-t UCL (Johnson-1978) | 31.44 |   |
| 796 |                                                                                                                                          |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 797 | <b>Gamma GOF Test</b>                                                                                                                    |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 798 | A-D Test Statistic                                                                                                                       | 0.504 | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |                                         |   |   |                                   |       |   |
| 799 | 5% A-D Critical Value                                                                                                                    | 0.76  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |                                         |   |   |                                   |       |   |
| 800 | K-S Test Statistic                                                                                                                       | 0.101 | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |                                         |   |   |                                   |       |   |
| 801 | 5% K-S Critical Value                                                                                                                    | 0.143 | Detected data appear Gamma Distributed at 5% Significance Level |   |   |                                         |   |   |                                   |       |   |
| 802 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 803 |                                                                                                                                          |       |                                                                 |   |   |                                         |   |   |                                   |       |   |
| 804 | <b>Gamma Statistics</b>                                                                                                                  |       |                                                                 |   |   |                                         |   |   |                                   |       |   |

| A   | B | C | D | E                                                                                                                                        | F      | G | H | I | J                                                 | K | L      |
|-----|---|---|---|------------------------------------------------------------------------------------------------------------------------------------------|--------|---|---|---|---------------------------------------------------|---|--------|
| 805 |   |   |   | k hat (MLE)                                                                                                                              | 1.95   |   |   |   | k star (bias corrected MLE)                       |   | 1.817  |
| 806 |   |   |   | Theta hat (MLE)                                                                                                                          | 13.37  |   |   |   | Theta star (bias corrected MLE)                   |   | 14.35  |
| 807 |   |   |   | nu hat (MLE)                                                                                                                             | 152.1  |   |   |   | nu star (bias corrected)                          |   | 141.7  |
| 808 |   |   |   | MLE Mean (bias corrected)                                                                                                                | 26.07  |   |   |   | MLE Sd (bias corrected)                           |   | 19.34  |
| 809 |   |   |   |                                                                                                                                          |        |   |   |   | Approximate Chi Square Value (0.05)               |   | 115.2  |
| 810 |   |   |   | Adjusted Level of Significance                                                                                                           | 0.0437 |   |   |   | Adjusted Chi Square Value                         |   | 114.3  |
| 811 |   |   |   |                                                                                                                                          |        |   |   |   |                                                   |   |        |
| 812 |   |   |   | <b>Assuming Gamma Distribution</b>                                                                                                       |        |   |   |   |                                                   |   |        |
| 813 |   |   |   | 95% Approximate Gamma UCL (use when n>=50)                                                                                               | 32.07  |   |   |   | 95% Adjusted Gamma UCL (use when n<50)            |   | 32.33  |
| 814 |   |   |   |                                                                                                                                          |        |   |   |   |                                                   |   |        |
| 815 |   |   |   | <b>Lognormal GOF Test</b>                                                                                                                |        |   |   |   |                                                   |   |        |
| 816 |   |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.95   |   |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>            |   |        |
| 817 |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                           | 0.939  |   |   |   | Data appear Lognormal at 5% Significance Level    |   |        |
| 818 |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.111  |   |   |   | <b>Lilliefors Lognormal GOF Test</b>              |   |        |
| 819 |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.14   |   |   |   | Data appear Lognormal at 5% Significance Level    |   |        |
| 820 |   |   |   | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |        |   |   |   |                                                   |   |        |
| 821 |   |   |   |                                                                                                                                          |        |   |   |   |                                                   |   |        |
| 822 |   |   |   | <b>Lognormal Statistics</b>                                                                                                              |        |   |   |   |                                                   |   |        |
| 823 |   |   |   | Minimum of Logged Data                                                                                                                   | 1.629  |   |   |   | Mean of logged Data                               |   | 2.983  |
| 824 |   |   |   | Maximum of Logged Data                                                                                                                   | 4.419  |   |   |   | SD of logged Data                                 |   | 0.783  |
| 825 |   |   |   |                                                                                                                                          |        |   |   |   |                                                   |   |        |
| 826 |   |   |   | <b>Assuming Lognormal Distribution</b>                                                                                                   |        |   |   |   |                                                   |   |        |
| 827 |   |   |   | 95% H-UCL                                                                                                                                | 35.33  |   |   |   | 90% Chebyshev (MVUE) UCL                          |   | 37.63  |
| 828 |   |   |   | 95% Chebyshev (MVUE) UCL                                                                                                                 | 42.64  |   |   |   | 97.5% Chebyshev (MVUE) UCL                        |   | 49.6   |
| 829 |   |   |   | 99% Chebyshev (MVUE) UCL                                                                                                                 | 63.27  |   |   |   |                                                   |   |        |
| 830 |   |   |   |                                                                                                                                          |        |   |   |   |                                                   |   |        |
| 831 |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |   |   |   |                                                   |   |        |
| 832 |   |   |   | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |        |   |   |   |                                                   |   |        |
| 833 |   |   |   |                                                                                                                                          |        |   |   |   |                                                   |   |        |
| 834 |   |   |   | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |        |   |   |   |                                                   |   |        |
| 835 |   |   |   | 95% CLT UCL                                                                                                                              | 31.21  |   |   |   | 95% Jackknife UCL                                 |   | 31.34  |
| 836 |   |   |   | 95% Standard Bootstrap UCL                                                                                                               | 31.2   |   |   |   | 95% Bootstrap-t UCL                               |   | 32.03  |
| 837 |   |   |   | 95% Hall's Bootstrap UCL                                                                                                                 | 32.1   |   |   |   | 95% Percentile Bootstrap UCL                      |   | 31.35  |
| 838 |   |   |   | 95% BCA Bootstrap UCL                                                                                                                    | 31.75  |   |   |   |                                                   |   |        |
| 839 |   |   |   | 90% Chebyshev(Mean, Sd) UCL                                                                                                              | 35.44  |   |   |   | 95% Chebyshev(Mean, Sd) UCL                       |   | 39.69  |
| 840 |   |   |   | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            | 45.58  |   |   |   | 99% Chebyshev(Mean, Sd) UCL                       |   | 57.15  |
| 841 |   |   |   |                                                                                                                                          |        |   |   |   |                                                   |   |        |
| 842 |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |        |   |   |   |                                                   |   |        |
| 843 |   |   |   | 95% Adjusted Gamma UCL                                                                                                                   | 32.33  |   |   |   |                                                   |   |        |
| 844 |   |   |   |                                                                                                                                          |        |   |   |   |                                                   |   |        |
| 845 |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |   |   |   |                                                   |   |        |
| 846 |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |   |   |   |                                                   |   |        |
| 847 |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |   |   |   |                                                   |   |        |
| 848 |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |   |   |   |                                                   |   |        |
| 849 |   |   |   |                                                                                                                                          |        |   |   |   |                                                   |   |        |
| 850 |   |   |   | <b>Result (eu7_cadmium)</b>                                                                                                              |        |   |   |   |                                                   |   |        |
| 851 |   |   |   |                                                                                                                                          |        |   |   |   |                                                   |   |        |
| 852 |   |   |   | <b>General Statistics</b>                                                                                                                |        |   |   |   |                                                   |   |        |
| 853 |   |   |   | Total Number of Observations                                                                                                             | 39     |   |   |   | Number of Distinct Observations                   |   | 37     |
| 854 |   |   |   | Number of Detects                                                                                                                        | 38     |   |   |   | Number of Non-Detects                             |   | 1      |
| 855 |   |   |   | Number of Distinct Detects                                                                                                               | 36     |   |   |   | Number of Distinct Non-Detects                    |   | 1      |
| 856 |   |   |   | Minimum Detect                                                                                                                           | 0.199  |   |   |   | Minimum Non-Detect                                |   | 0.064  |
| 857 |   |   |   | Maximum Detect                                                                                                                           | 268    |   |   |   | Maximum Non-Detect                                |   | 0.064  |
| 858 |   |   |   | Variance Detects                                                                                                                         | 1841   |   |   |   | Percent Non-Detects                               |   | 2.564% |
| 859 |   |   |   | Mean Detects                                                                                                                             | 11.87  |   |   |   | SD Detects                                        |   | 42.91  |
| 860 |   |   |   | Median Detects                                                                                                                           | 3.2    |   |   |   | CV Detects                                        |   | 3.615  |
| 861 |   |   |   | Skewness Detects                                                                                                                         | 6.059  |   |   |   | Kurtosis Detects                                  |   | 37.1   |
| 862 |   |   |   | Mean of Logged Detects                                                                                                                   | 1.063  |   |   |   | SD of Logged Detects                              |   | 1.529  |
| 863 |   |   |   |                                                                                                                                          |        |   |   |   |                                                   |   |        |
| 864 |   |   |   | <b>Normal GOF Test on Detects Only</b>                                                                                                   |        |   |   |   |                                                   |   |        |
| 865 |   |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.242  |   |   |   | <b>Shapiro Wilk GOF Test</b>                      |   |        |
| 866 |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                           | 0.938  |   |   |   | Detected Data Not Normal at 5% Significance Level |   |        |
| 867 |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.45   |   |   |   | <b>Lilliefors GOF Test</b>                        |   |        |
| 868 |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.142  |   |   |   | Detected Data Not Normal at 5% Significance Level |   |        |
| 869 |   |   |   | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |        |   |   |   |                                                   |   |        |
| 870 |   |   |   |                                                                                                                                          |        |   |   |   |                                                   |   |        |
| 871 |   |   |   | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |        |   |   |   |                                                   |   |        |

| A   | B                                                                                                                         | C | D | E                                                   | F      | G | H | I                                                            | J | K | L      |  |
|-----|---------------------------------------------------------------------------------------------------------------------------|---|---|-----------------------------------------------------|--------|---|---|--------------------------------------------------------------|---|---|--------|--|
| 872 |                                                                                                                           |   |   | KM Mean                                             | 11.57  |   |   | KM Standard Error of Mean                                    |   |   | 6.789  |  |
| 873 |                                                                                                                           |   |   | KM SD                                               | 41.84  |   |   | 95% KM (BCA) UCL                                             |   |   | 25.85  |  |
| 874 |                                                                                                                           |   |   | 95% KM (t) UCL                                      | 23.01  |   |   | 95% KM (Percentile Bootstrap) UCL                            |   |   | 24.95  |  |
| 875 |                                                                                                                           |   |   | 95% KM (z) UCL                                      | 22.73  |   |   | 95% KM Bootstrap t UCL                                       |   |   | 88.67  |  |
| 876 |                                                                                                                           |   |   | 90% KM Chebyshev UCL                                | 31.93  |   |   | 95% KM Chebyshev UCL                                         |   |   | 41.16  |  |
| 877 |                                                                                                                           |   |   | 97.5% KM Chebyshev UCL                              | 53.96  |   |   | 99% KM Chebyshev UCL                                         |   |   | 79.11  |  |
| 878 |                                                                                                                           |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 879 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 880 |                                                                                                                           |   |   | A-D Test Statistic                                  | 2.649  |   |   | <b>Anderson-Darling GOF Test</b>                             |   |   |        |  |
| 881 |                                                                                                                           |   |   | 5% A-D Critical Value                               | 0.822  |   |   | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |        |  |
| 882 |                                                                                                                           |   |   | K-S Test Statistic                                  | 0.239  |   |   | <b>Kolmogorov-Smirnov GOF</b>                                |   |   |        |  |
| 883 |                                                                                                                           |   |   | 5% K-S Critical Value                               | 0.152  |   |   | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |        |  |
| 884 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                       |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 885 |                                                                                                                           |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 886 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 887 |                                                                                                                           |   |   | k hat (MLE)                                         | 0.457  |   |   | k star (bias corrected MLE)                                  |   |   | 0.438  |  |
| 888 |                                                                                                                           |   |   | Theta hat (MLE)                                     | 25.99  |   |   | Theta star (bias corrected MLE)                              |   |   | 27.09  |  |
| 889 |                                                                                                                           |   |   | nu hat (MLE)                                        | 34.71  |   |   | nu star (bias corrected)                                     |   |   | 33.3   |  |
| 890 |                                                                                                                           |   |   | Mean (detects)                                      | 11.87  |   |   |                                                              |   |   |        |  |
| 891 |                                                                                                                           |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 892 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 893 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 894 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 895 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 896 | This is especially true when the sample size is small.                                                                    |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 897 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 898 |                                                                                                                           |   |   | Minimum                                             | 0.01   |   |   | Mean                                                         |   |   | 11.56  |  |
| 899 |                                                                                                                           |   |   | Maximum                                             | 268    |   |   | Median                                                       |   |   | 2.8    |  |
| 900 |                                                                                                                           |   |   | SD                                                  | 42.38  |   |   | CV                                                           |   |   | 3.665  |  |
| 901 |                                                                                                                           |   |   | k hat (MLE)                                         | 0.426  |   |   | k star (bias corrected MLE)                                  |   |   | 0.41   |  |
| 902 |                                                                                                                           |   |   | Theta hat (MLE)                                     | 27.16  |   |   | Theta star (bias corrected MLE)                              |   |   | 28.2   |  |
| 903 |                                                                                                                           |   |   | nu hat (MLE)                                        | 33.21  |   |   | nu star (bias corrected)                                     |   |   | 31.99  |  |
| 904 |                                                                                                                           |   |   | Adjusted Level of Significance ( $\beta$ )          | 0.0437 |   |   |                                                              |   |   |        |  |
| 905 |                                                                                                                           |   |   | Approximate Chi Square Value (31.99, $\alpha$ )     | 20.06  |   |   | Adjusted Chi Square Value (31.99, $\beta$ )                  |   |   | 19.69  |  |
| 906 |                                                                                                                           |   |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )   | 18.44  |   |   | 95% Gamma Adjusted UCL (use when $n < 50$ )                  |   |   | 18.79  |  |
| 907 |                                                                                                                           |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 908 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 909 |                                                                                                                           |   |   | Mean (KM)                                           | 11.57  |   |   | SD (KM)                                                      |   |   | 41.84  |  |
| 910 |                                                                                                                           |   |   | Variance (KM)                                       | 1750   |   |   | SE of Mean (KM)                                              |   |   | 6.789  |  |
| 911 |                                                                                                                           |   |   | k hat (KM)                                          | 0.0764 |   |   | k star (KM)                                                  |   |   | 0.0876 |  |
| 912 |                                                                                                                           |   |   | nu hat (KM)                                         | 5.962  |   |   | nu star (KM)                                                 |   |   | 6.836  |  |
| 913 |                                                                                                                           |   |   | theta hat (KM)                                      | 151.3  |   |   | theta star (KM)                                              |   |   | 132    |  |
| 914 |                                                                                                                           |   |   | 80% gamma percentile (KM)                           | 6.51   |   |   | 90% gamma percentile (KM)                                    |   |   | 28.92  |  |
| 915 |                                                                                                                           |   |   | 95% gamma percentile (KM)                           | 67.39  |   |   | 99% gamma percentile (KM)                                    |   |   | 196.1  |  |
| 916 |                                                                                                                           |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 917 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 918 |                                                                                                                           |   |   | Approximate Chi Square Value (6.84, $\alpha$ )      | 2.081  |   |   | Adjusted Chi Square Value (6.84, $\beta$ )                   |   |   | 1.979  |  |
| 919 |                                                                                                                           |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ ) | 37.99  |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )               |   |   | 39.94  |  |
| 920 | 95% Gamma Adjusted KM-UCL (use when $k \leq 1$ and $15 < n < 50$ )                                                        |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 921 |                                                                                                                           |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 922 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 923 |                                                                                                                           |   |   | Shapiro Wilk Test Statistic                         | 0.94   |   |   | <b>Shapiro Wilk GOF Test</b>                                 |   |   |        |  |
| 924 |                                                                                                                           |   |   | 5% Shapiro Wilk Critical Value                      | 0.938  |   |   | Detected Data appear Lognormal at 5% Significance Level      |   |   |        |  |
| 925 |                                                                                                                           |   |   | Lilliefors Test Statistic                           | 0.131  |   |   | <b>Lilliefors GOF Test</b>                                   |   |   |        |  |
| 926 |                                                                                                                           |   |   | 5% Lilliefors Critical Value                        | 0.142  |   |   | Detected Data appear Lognormal at 5% Significance Level      |   |   |        |  |
| 927 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                            |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 928 |                                                                                                                           |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 929 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 930 |                                                                                                                           |   |   | Mean in Original Scale                              | 11.57  |   |   | Mean in Log Scale                                            |   |   | 0.965  |  |
| 931 |                                                                                                                           |   |   | SD in Original Scale                                | 42.38  |   |   | SD in Log Scale                                              |   |   | 1.627  |  |
| 932 |                                                                                                                           |   |   | 95% t UCL (assumes normality of ROS data)           | 23.01  |   |   | 95% Percentile Bootstrap UCL                                 |   |   | 25.04  |  |
| 933 |                                                                                                                           |   |   | 95% BCA Bootstrap UCL                               | 32.44  |   |   | 95% Bootstrap t UCL                                          |   |   | 87.97  |  |
| 934 |                                                                                                                           |   |   | 95% H-UCL (Log ROS)                                 | 23.08  |   |   |                                                              |   |   |        |  |
| 935 |                                                                                                                           |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 936 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |   |   |                                                     |        |   |   |                                                              |   |   |        |  |
| 937 |                                                                                                                           |   |   | KM Mean (logged)                                    | 0.965  |   |   | KM Geo Mean                                                  |   |   | 2.626  |  |
| 938 |                                                                                                                           |   |   | KM SD (logged)                                      | 1.606  |   |   | 95% Critical H Value (KM-Log)                                |   |   | 3.187  |  |

| A    | B                                                                                                                                        | C | D | E      | F                                                               | G                           | H | I      | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------------------|-----------------------------|---|--------|---|---|---|
| 939  | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.261  | 95% H-UCL (KM -Log)                                             |                             |   | 21.88  |   |   |   |
| 940  | KM SD (logged)                                                                                                                           |   |   | 1.606  | 95% Critical H Value (KM-Log)                                   |                             |   | 3.187  |   |   |   |
| 941  | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.261  |                                                                 |                             |   |        |   |   |   |
| 942  |                                                                                                                                          |   |   |        |                                                                 |                             |   |        |   |   |   |
| 943  | <b>DL/2 Statistics</b>                                                                                                                   |   |   |        |                                                                 |                             |   |        |   |   |   |
| 944  | <b>DL/2 Normal</b>                                                                                                                       |   |   |        |                                                                 | <b>DL/2 Log-Transformed</b> |   |        |   |   |   |
| 945  | Mean in Original Scale                                                                                                                   |   |   | 11.57  | Mean in Log Scale                                               |                             |   | 0.948  |   |   |   |
| 946  | SD in Original Scale                                                                                                                     |   |   | 42.38  | SD in Log Scale                                                 |                             |   | 1.672  |   |   |   |
| 947  | 95% t UCL (Assumes normality)                                                                                                            |   |   | 23.01  | 95% H-Stat UCL                                                  |                             |   | 25.41  |   |   |   |
| 948  | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |   |        |                                                                 |                             |   |        |   |   |   |
| 949  |                                                                                                                                          |   |   |        |                                                                 |                             |   |        |   |   |   |
| 950  | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |                                                                 |                             |   |        |   |   |   |
| 951  | <b>Detected Data appear Lognormal Distributed at 5% Significance Level</b>                                                               |   |   |        |                                                                 |                             |   |        |   |   |   |
| 952  |                                                                                                                                          |   |   |        |                                                                 |                             |   |        |   |   |   |
| 953  | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                                 |                             |   |        |   |   |   |
| 954  | 95% KM (Chebyshev) UCL                                                                                                                   |   |   | 41.16  |                                                                 |                             |   |        |   |   |   |
| 955  |                                                                                                                                          |   |   |        |                                                                 |                             |   |        |   |   |   |
| 956  | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                                 |                             |   |        |   |   |   |
| 957  | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                                 |                             |   |        |   |   |   |
| 958  | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                                 |                             |   |        |   |   |   |
| 959  | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                                 |                             |   |        |   |   |   |
| 960  |                                                                                                                                          |   |   |        |                                                                 |                             |   |        |   |   |   |
| 961  | <b>Result (eu7_chromium)</b>                                                                                                             |   |   |        |                                                                 |                             |   |        |   |   |   |
| 962  |                                                                                                                                          |   |   |        |                                                                 |                             |   |        |   |   |   |
| 963  | <b>General Statistics</b>                                                                                                                |   |   |        |                                                                 |                             |   |        |   |   |   |
| 964  | Total Number of Observations                                                                                                             |   |   | 39     | Number of Distinct Observations                                 |                             |   | 31     |   |   |   |
| 965  | Number of Detects                                                                                                                        |   |   | 37     | Number of Non-Detects                                           |                             |   | 2      |   |   |   |
| 966  | Number of Distinct Detects                                                                                                               |   |   | 29     | Number of Distinct Non-Detects                                  |                             |   | 2      |   |   |   |
| 967  | Minimum Detect                                                                                                                           |   |   | 1.9    | Minimum Non-Detect                                              |                             |   | 2.49   |   |   |   |
| 968  | Maximum Detect                                                                                                                           |   |   | 6.6    | Maximum Non-Detect                                              |                             |   | 5.03   |   |   |   |
| 969  | Variance Detects                                                                                                                         |   |   | 1.069  | Percent Non-Detects                                             |                             |   | 5.128% |   |   |   |
| 970  | Mean Detects                                                                                                                             |   |   | 3.832  | SD Detects                                                      |                             |   | 1.034  |   |   |   |
| 971  | Median Detects                                                                                                                           |   |   | 3.71   | CV Detects                                                      |                             |   | 0.27   |   |   |   |
| 972  | Skewness Detects                                                                                                                         |   |   | 0.348  | Kurtosis Detects                                                |                             |   | 0.359  |   |   |   |
| 973  | Mean of Logged Detects                                                                                                                   |   |   | 1.306  | SD of Logged Detects                                            |                             |   | 0.283  |   |   |   |
| 974  |                                                                                                                                          |   |   |        |                                                                 |                             |   |        |   |   |   |
| 975  | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |   |        |                                                                 |                             |   |        |   |   |   |
| 976  | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.976  | <b>Shapiro Wilk GOF Test</b>                                    |                             |   |        |   |   |   |
| 977  | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.936  | Detected Data appear Normal at 5% Significance Level            |                             |   |        |   |   |   |
| 978  | Lilliefors Test Statistic                                                                                                                |   |   | 0.0811 | <b>Lilliefors GOF Test</b>                                      |                             |   |        |   |   |   |
| 979  | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.144  | Detected Data appear Normal at 5% Significance Level            |                             |   |        |   |   |   |
| 980  | <b>Detected Data appear Normal at 5% Significance Level</b>                                                                              |   |   |        |                                                                 |                             |   |        |   |   |   |
| 981  |                                                                                                                                          |   |   |        |                                                                 |                             |   |        |   |   |   |
| 982  | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |   |        |                                                                 |                             |   |        |   |   |   |
| 983  | KM Mean                                                                                                                                  |   |   | 3.774  | KM Standard Error of Mean                                       |                             |   | 0.171  |   |   |   |
| 984  | KM SD                                                                                                                                    |   |   | 1.045  | 95% KM (BCA) UCL                                                |                             |   | 4.055  |   |   |   |
| 985  | 95% KM (t) UCL                                                                                                                           |   |   | 4.063  | 95% KM (Percentile Bootstrap) UCL                               |                             |   | 4.055  |   |   |   |
| 986  | 95% KM (z) UCL                                                                                                                           |   |   | 4.055  | 95% KM Bootstrap t UCL                                          |                             |   | 4.061  |   |   |   |
| 987  | 90% KM Chebyshev UCL                                                                                                                     |   |   | 4.287  | 95% KM Chebyshev UCL                                            |                             |   | 4.519  |   |   |   |
| 988  | 97.5% KM Chebyshev UCL                                                                                                                   |   |   | 4.842  | 99% KM Chebyshev UCL                                            |                             |   | 5.475  |   |   |   |
| 989  |                                                                                                                                          |   |   |        |                                                                 |                             |   |        |   |   |   |
| 990  | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |   |   |        |                                                                 |                             |   |        |   |   |   |
| 991  | A-D Test Statistic                                                                                                                       |   |   | 0.301  | <b>Anderson-Darling GOF Test</b>                                |                             |   |        |   |   |   |
| 992  | 5% A-D Critical Value                                                                                                                    |   |   | 0.748  | Detected data appear Gamma Distributed at 5% Significance Level |                             |   |        |   |   |   |
| 993  | K-S Test Statistic                                                                                                                       |   |   | 0.0917 | <b>Kolmogorov-Smirnov GOF</b>                                   |                             |   |        |   |   |   |
| 994  | 5% K-S Critical Value                                                                                                                    |   |   | 0.145  | Detected data appear Gamma Distributed at 5% Significance Level |                             |   |        |   |   |   |
| 995  | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |        |                                                                 |                             |   |        |   |   |   |
| 996  |                                                                                                                                          |   |   |        |                                                                 |                             |   |        |   |   |   |
| 997  | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |   |   |        |                                                                 |                             |   |        |   |   |   |
| 998  | k hat (MLE)                                                                                                                              |   |   | 13.59  | k star (bias corrected MLE)                                     |                             |   | 12.5   |   |   |   |
| 999  | Theta hat (MLE)                                                                                                                          |   |   | 0.282  | Theta star (bias corrected MLE)                                 |                             |   | 0.306  |   |   |   |
| 1000 | nu hat (MLE)                                                                                                                             |   |   | 1005   | nu star (bias corrected)                                        |                             |   | 925.3  |   |   |   |
| 1001 | Mean (detects)                                                                                                                           |   |   | 3.832  |                                                                 |                             |   |        |   |   |   |
| 1002 |                                                                                                                                          |   |   |        |                                                                 |                             |   |        |   |   |   |
| 1003 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |   |   |        |                                                                 |                             |   |        |   |   |   |
| 1004 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |   |   |        |                                                                 |                             |   |        |   |   |   |
| 1005 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |   |   |        |                                                                 |                             |   |        |   |   |   |

| A    | B                                                                                                                                        | C      | D | E                                                       | F     | G                           | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------|---|---------------------------------------------------------|-------|-----------------------------|---|---|---|---|---|
| 1006 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |        |   |                                                         |       |                             |   |   |   |   |   |
| 1007 | This is especially true when the sample size is small.                                                                                   |        |   |                                                         |       |                             |   |   |   |   |   |
| 1008 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |        |   |                                                         |       |                             |   |   |   |   |   |
| 1009 | Minimum                                                                                                                                  | 1.9    |   | Mean                                                    | 3.781 |                             |   |   |   |   |   |
| 1010 | Maximum                                                                                                                                  | 6.6    |   | Median                                                  | 3.6   |                             |   |   |   |   |   |
| 1011 | SD                                                                                                                                       | 1.041  |   | CV                                                      | 0.275 |                             |   |   |   |   |   |
| 1012 | k hat (MLE)                                                                                                                              | 13.1   |   | k star (bias corrected MLE)                             | 12.11 |                             |   |   |   |   |   |
| 1013 | Theta hat (MLE)                                                                                                                          | 0.289  |   | Theta star (bias corrected MLE)                         | 0.312 |                             |   |   |   |   |   |
| 1014 | nu hat (MLE)                                                                                                                             | 1022   |   | nu star (bias corrected)                                | 944.3 |                             |   |   |   |   |   |
| 1015 | Adjusted Level of Significance ( $\beta$ )                                                                                               | 0.0437 |   |                                                         |       |                             |   |   |   |   |   |
| 1016 | Approximate Chi Square Value (944.26, $\alpha$ )                                                                                         | 873.9  |   | Adjusted Chi Square Value (944.26, $\beta$ )            | 871.3 |                             |   |   |   |   |   |
| 1017 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                                        | 4.085  |   | 95% Gamma Adjusted UCL (use when $n < 50$ )             | 4.098 |                             |   |   |   |   |   |
| 1018 |                                                                                                                                          |        |   |                                                         |       |                             |   |   |   |   |   |
| 1019 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |        |   |                                                         |       |                             |   |   |   |   |   |
| 1020 | Mean (KM)                                                                                                                                | 3.774  |   | SD (KM)                                                 | 1.045 |                             |   |   |   |   |   |
| 1021 | Variance (KM)                                                                                                                            | 1.092  |   | SE of Mean (KM)                                         | 0.171 |                             |   |   |   |   |   |
| 1022 | k hat (KM)                                                                                                                               | 13.05  |   | k star (KM)                                             | 12.06 |                             |   |   |   |   |   |
| 1023 | nu hat (KM)                                                                                                                              | 1018   |   | nu star (KM)                                            | 940.8 |                             |   |   |   |   |   |
| 1024 | theta hat (KM)                                                                                                                           | 0.289  |   | theta star (KM)                                         | 0.313 |                             |   |   |   |   |   |
| 1025 | 80% gamma percentile (KM)                                                                                                                | 4.646  |   | 90% gamma percentile (KM)                               | 5.217 |                             |   |   |   |   |   |
| 1026 | 95% gamma percentile (KM)                                                                                                                | 5.722  |   | 99% gamma percentile (KM)                               | 6.751 |                             |   |   |   |   |   |
| 1027 |                                                                                                                                          |        |   |                                                         |       |                             |   |   |   |   |   |
| 1028 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |        |   |                                                         |       |                             |   |   |   |   |   |
| 1029 | Approximate Chi Square Value (940.78, $\alpha$ )                                                                                         | 870.6  |   | Adjusted Chi Square Value (940.78, $\beta$ )            | 867.9 |                             |   |   |   |   |   |
| 1030 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                      | 4.079  |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )          | 4.091 |                             |   |   |   |   |   |
| 1031 |                                                                                                                                          |        |   |                                                         |       |                             |   |   |   |   |   |
| 1032 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |        |   |                                                         |       |                             |   |   |   |   |   |
| 1033 | Shapiro Wilk Test Statistic                                                                                                              | 0.962  |   | <b>Shapiro Wilk GOF Test</b>                            |       |                             |   |   |   |   |   |
| 1034 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.936  |   | Detected Data appear Lognormal at 5% Significance Level |       |                             |   |   |   |   |   |
| 1035 | Lilliefors Test Statistic                                                                                                                | 0.106  |   | <b>Lilliefors GOF Test</b>                              |       |                             |   |   |   |   |   |
| 1036 | 5% Lilliefors Critical Value                                                                                                             | 0.144  |   | Detected Data appear Lognormal at 5% Significance Level |       |                             |   |   |   |   |   |
| 1037 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                           |        |   |                                                         |       |                             |   |   |   |   |   |
| 1038 |                                                                                                                                          |        |   |                                                         |       |                             |   |   |   |   |   |
| 1039 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |        |   |                                                         |       |                             |   |   |   |   |   |
| 1040 | Mean in Original Scale                                                                                                                   | 3.781  |   | Mean in Log Scale                                       | 1.291 |                             |   |   |   |   |   |
| 1041 | SD in Original Scale                                                                                                                     | 1.039  |   | SD in Log Scale                                         | 0.287 |                             |   |   |   |   |   |
| 1042 | 95% t UCL (assumes normality of ROS data)                                                                                                | 4.061  |   | 95% Percentile Bootstrap UCL                            | 4.063 |                             |   |   |   |   |   |
| 1043 | 95% BCA Bootstrap UCL                                                                                                                    | 4.076  |   | 95% Bootstrap t UCL                                     | 4.092 |                             |   |   |   |   |   |
| 1044 | 95% H-UCL (Log ROS)                                                                                                                      | 4.118  |   |                                                         |       |                             |   |   |   |   |   |
| 1045 |                                                                                                                                          |        |   |                                                         |       |                             |   |   |   |   |   |
| 1046 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |        |   |                                                         |       |                             |   |   |   |   |   |
| 1047 | KM Mean (logged)                                                                                                                         | 1.288  |   | KM Geo Mean                                             | 3.624 |                             |   |   |   |   |   |
| 1048 | KM SD (logged)                                                                                                                           | 0.293  |   | 95% Critical H Value (KM-Log)                           | 1.785 |                             |   |   |   |   |   |
| 1049 | KM Standard Error of Mean (logged)                                                                                                       | 0.048  |   | 95% H-UCL (KM -Log)                                     | 4.117 |                             |   |   |   |   |   |
| 1050 | KM SD (logged)                                                                                                                           | 0.293  |   | 95% Critical H Value (KM-Log)                           | 1.785 |                             |   |   |   |   |   |
| 1051 | KM Standard Error of Mean (logged)                                                                                                       | 0.048  |   |                                                         |       |                             |   |   |   |   |   |
| 1052 |                                                                                                                                          |        |   |                                                         |       |                             |   |   |   |   |   |
| 1053 | <b>DL/2 Statistics</b>                                                                                                                   |        |   |                                                         |       |                             |   |   |   |   |   |
| 1054 | <b>DL/2 Normal</b>                                                                                                                       |        |   |                                                         |       | <b>DL/2 Log-Transformed</b> |   |   |   |   |   |
| 1055 | Mean in Original Scale                                                                                                                   | 3.732  |   | Mean in Log Scale                                       | 1.268 |                             |   |   |   |   |   |
| 1056 | SD in Original Scale                                                                                                                     | 1.106  |   | SD in Log Scale                                         | 0.331 |                             |   |   |   |   |   |
| 1057 | 95% t UCL (Assumes normality)                                                                                                            | 4.03   |   | 95% H-Stat UCL                                          | 4.137 |                             |   |   |   |   |   |
| 1058 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |        |   |                                                         |       |                             |   |   |   |   |   |
| 1059 |                                                                                                                                          |        |   |                                                         |       |                             |   |   |   |   |   |
| 1060 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |   |                                                         |       |                             |   |   |   |   |   |
| 1061 | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                  |        |   |                                                         |       |                             |   |   |   |   |   |
| 1062 |                                                                                                                                          |        |   |                                                         |       |                             |   |   |   |   |   |
| 1063 | <b>Suggested UCL to Use</b>                                                                                                              |        |   |                                                         |       |                             |   |   |   |   |   |
| 1064 | 95% KM (t) UCL                                                                                                                           | 4.063  |   |                                                         |       |                             |   |   |   |   |   |
| 1065 |                                                                                                                                          |        |   |                                                         |       |                             |   |   |   |   |   |
| 1066 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |   |                                                         |       |                             |   |   |   |   |   |
| 1067 | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |   |                                                         |       |                             |   |   |   |   |   |
| 1068 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |   |                                                         |       |                             |   |   |   |   |   |
| 1069 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |   |                                                         |       |                             |   |   |   |   |   |
| 1070 |                                                                                                                                          |        |   |                                                         |       |                             |   |   |   |   |   |
| 1071 |                                                                                                                                          |        |   |                                                         |       |                             |   |   |   |   |   |
| 1072 | <b>Result (eu7_cobalt)</b>                                                                                                               |        |   |                                                         |       |                             |   |   |   |   |   |

|      | A                                                                                | B | C | D      | E | F                                                               | G | H | I      | J | K | L |
|------|----------------------------------------------------------------------------------|---|---|--------|---|-----------------------------------------------------------------|---|---|--------|---|---|---|
| 1073 |                                                                                  |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1074 | <b>General Statistics</b>                                                        |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1075 | Total Number of Observations                                                     |   |   | 29     |   | Number of Distinct Observations                                 |   |   | 24     |   |   |   |
| 1076 |                                                                                  |   |   |        |   | Number of Missing Observations                                  |   |   | 0      |   |   |   |
| 1077 | Minimum                                                                          |   |   | 3      |   | Mean                                                            |   |   | 10.9   |   |   |   |
| 1078 | Maximum                                                                          |   |   | 21.5   |   | Median                                                          |   |   | 12     |   |   |   |
| 1079 | SD                                                                               |   |   | 4.588  |   | Std. Error of Mean                                              |   |   | 0.852  |   |   |   |
| 1080 | Coefficient of Variation                                                         |   |   | 0.421  |   | Skewness                                                        |   |   | 0.0834 |   |   |   |
| 1081 |                                                                                  |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1082 | <b>Normal GOF Test</b>                                                           |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1083 | Shapiro Wilk Test Statistic                                                      |   |   | 0.961  |   | <b>Shapiro Wilk GOF Test</b>                                    |   |   |        |   |   |   |
| 1084 | 5% Shapiro Wilk Critical Value                                                   |   |   | 0.926  |   | Data appear Normal at 5% Significance Level                     |   |   |        |   |   |   |
| 1085 | Lilliefors Test Statistic                                                        |   |   | 0.112  |   | <b>Lilliefors GOF Test</b>                                      |   |   |        |   |   |   |
| 1086 | 5% Lilliefors Critical Value                                                     |   |   | 0.161  |   | Data appear Normal at 5% Significance Level                     |   |   |        |   |   |   |
| 1087 | <b>Data appear Normal at 5% Significance Level</b>                               |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1088 |                                                                                  |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1089 | <b>Assuming Normal Distribution</b>                                              |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1090 | <b>95% Normal UCL</b>                                                            |   |   |        |   | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |        |   |   |   |
| 1091 | 95% Student's-t UCL                                                              |   |   | 12.35  |   | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   | 12.32  |   |   |   |
| 1092 |                                                                                  |   |   |        |   | 95% Modified-t UCL (Johnson-1978)                               |   |   | 12.36  |   |   |   |
| 1093 |                                                                                  |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1094 | <b>Gamma GOF Test</b>                                                            |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1095 | A-D Test Statistic                                                               |   |   | 0.741  |   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |        |   |   |   |
| 1096 | 5% A-D Critical Value                                                            |   |   | 0.748  |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |        |   |   |   |
| 1097 | K-S Test Statistic                                                               |   |   | 0.165  |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |        |   |   |   |
| 1098 | 5% K-S Critical Value                                                            |   |   | 0.163  |   | Data Not Gamma Distributed at 5% Significance Level             |   |   |        |   |   |   |
| 1099 | <b>Detected data follow Appr. Gamma Distribution at 5% Significance Level</b>    |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1100 |                                                                                  |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1101 | <b>Gamma Statistics</b>                                                          |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1102 | k hat (MLE)                                                                      |   |   | 4.882  |   | k star (bias corrected MLE)                                     |   |   | 4.4    |   |   |   |
| 1103 | Theta hat (MLE)                                                                  |   |   | 2.234  |   | Theta star (bias corrected MLE)                                 |   |   | 2.478  |   |   |   |
| 1104 | nu hat (MLE)                                                                     |   |   | 283.2  |   | nu star (bias corrected)                                        |   |   | 255.2  |   |   |   |
| 1105 | MLE Mean (bias corrected)                                                        |   |   | 10.9   |   | MLE Sd (bias corrected)                                         |   |   | 5.198  |   |   |   |
| 1106 |                                                                                  |   |   |        |   | Approximate Chi Square Value (0.05)                             |   |   | 219.2  |   |   |   |
| 1107 | Adjusted Level of Significance                                                   |   |   | 0.0407 |   | Adjusted Chi Square Value                                       |   |   | 217.2  |   |   |   |
| 1108 |                                                                                  |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1109 | <b>Assuming Gamma Distribution</b>                                               |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1110 | 95% Approximate Gamma UCL (use when n>=50))                                      |   |   | 12.69  |   | 95% Adjusted Gamma UCL (use when n<50)                          |   |   | 12.81  |   |   |   |
| 1111 |                                                                                  |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1112 | <b>Lognormal GOF Test</b>                                                        |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1113 | Shapiro Wilk Test Statistic                                                      |   |   | 0.917  |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |        |   |   |   |
| 1114 | 5% Shapiro Wilk Critical Value                                                   |   |   | 0.926  |   | Data Not Lognormal at 5% Significance Level                     |   |   |        |   |   |   |
| 1115 | Lilliefors Test Statistic                                                        |   |   | 0.183  |   | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |        |   |   |   |
| 1116 | 5% Lilliefors Critical Value                                                     |   |   | 0.161  |   | Data Not Lognormal at 5% Significance Level                     |   |   |        |   |   |   |
| 1117 | <b>Data Not Lognormal at 5% Significance Level</b>                               |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1118 |                                                                                  |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1119 | <b>Lognormal Statistics</b>                                                      |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1120 | Minimum of Logged Data                                                           |   |   | 1.099  |   | Mean of logged Data                                             |   |   | 2.283  |   |   |   |
| 1121 | Maximum of Logged Data                                                           |   |   | 3.068  |   | SD of logged Data                                               |   |   | 0.501  |   |   |   |
| 1122 |                                                                                  |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1123 | <b>Assuming Lognormal Distribution</b>                                           |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1124 | 95% H-UCL                                                                        |   |   | 13.38  |   | 90% Chebyshev (MVUE) UCL                                        |   |   | 14.3   |   |   |   |
| 1125 | 95% Chebyshev (MVUE) UCL                                                         |   |   | 15.76  |   | 97.5% Chebyshev (MVUE) UCL                                      |   |   | 17.78  |   |   |   |
| 1126 | 99% Chebyshev (MVUE) UCL                                                         |   |   | 21.77  |   |                                                                 |   |   |        |   |   |   |
| 1127 |                                                                                  |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1128 | <b>Nonparametric Distribution Free UCL Statistics</b>                            |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1129 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b> |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1130 |                                                                                  |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1131 | <b>Nonparametric Distribution Free UCLs</b>                                      |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1132 | 95% CLT UCL                                                                      |   |   | 12.31  |   | 95% Jackknife UCL                                               |   |   | 12.35  |   |   |   |
| 1133 | 95% Standard Bootstrap UCL                                                       |   |   | 12.29  |   | 95% Bootstrap-t UCL                                             |   |   | 12.36  |   |   |   |
| 1134 | 95% Hall's Bootstrap UCL                                                         |   |   | 12.33  |   | 95% Percentile Bootstrap UCL                                    |   |   | 12.27  |   |   |   |
| 1135 | 95% BCA Bootstrap UCL                                                            |   |   | 12.3   |   |                                                                 |   |   |        |   |   |   |
| 1136 | 90% Chebyshev(Mean, Sd) UCL                                                      |   |   | 13.46  |   | 95% Chebyshev(Mean, Sd) UCL                                     |   |   | 14.62  |   |   |   |
| 1137 | 97.5% Chebyshev(Mean, Sd) UCL                                                    |   |   | 16.22  |   | 99% Chebyshev(Mean, Sd) UCL                                     |   |   | 19.38  |   |   |   |
| 1138 |                                                                                  |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1139 | <b>Suggested UCL to Use</b>                                                      |   |   |        |   |                                                                 |   |   |        |   |   |   |

| A    | B                                                                                                                                        | C | D      | E                                   | F                                                   | G | H     | I     | J | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|-------------------------------------|-----------------------------------------------------|---|-------|-------|---|---|---|--|
| 1140 | 95% Student's-t UCL                                                                                                                      |   |        | 12.35                               |                                                     |   |       |       |   |   |   |  |
| 1141 |                                                                                                                                          |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1142 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1143 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1144 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1145 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1146 |                                                                                                                                          |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1147 |                                                                                                                                          |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1148 | <b>Result (eu7_copper)</b>                                                                                                               |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1149 |                                                                                                                                          |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1150 | <b>General Statistics</b>                                                                                                                |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1151 | Total Number of Observations                                                                                                             |   |        | 39                                  | Number of Distinct Observations                     |   |       | 38    |   |   |   |  |
| 1152 |                                                                                                                                          |   |        |                                     | Number of Missing Observations                      |   |       | 0     |   |   |   |  |
| 1153 | Minimum                                                                                                                                  |   | 13.9   | Mean                                |                                                     |   |       | 312.7 |   |   |   |  |
| 1154 | Maximum                                                                                                                                  |   | 5630   | Median                              |                                                     |   |       | 84.9  |   |   |   |  |
| 1155 | SD                                                                                                                                       |   | 888.8  | Std. Error of Mean                  |                                                     |   |       | 142.3 |   |   |   |  |
| 1156 | Coefficient of Variation                                                                                                                 |   | 2.842  | Skewness                            |                                                     |   |       | 5.926 |   |   |   |  |
| 1157 |                                                                                                                                          |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1158 | <b>Normal GOF Test</b>                                                                                                                   |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1159 | Shapiro Wilk Test Statistic                                                                                                              |   |        | 0.297                               | <b>Shapiro Wilk GOF Test</b>                        |   |       |       |   |   |   |  |
| 1160 | 5% Shapiro Wilk Critical Value                                                                                                           |   |        | 0.939                               | Data Not Normal at 5% Significance Level            |   |       |       |   |   |   |  |
| 1161 | Lilliefors Test Statistic                                                                                                                |   |        | 0.391                               | <b>Lilliefors GOF Test</b>                          |   |       |       |   |   |   |  |
| 1162 | 5% Lilliefors Critical Value                                                                                                             |   |        | 0.14                                | Data Not Normal at 5% Significance Level            |   |       |       |   |   |   |  |
| 1163 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1164 |                                                                                                                                          |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1165 | <b>Assuming Normal Distribution</b>                                                                                                      |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1166 | <b>95% Normal UCL</b>                                                                                                                    |   |        |                                     | <b>95% UCLs (Adjusted for Skewness)</b>             |   |       |       |   |   |   |  |
| 1167 | 95% Student's-t UCL                                                                                                                      |   |        | 552.7                               | 95% Adjusted-CLT UCL (Chen-1995)                    |   |       | 691.2 |   |   |   |  |
| 1168 |                                                                                                                                          |   |        |                                     | 95% Modified-t UCL (Johnson-1978)                   |   |       | 575.2 |   |   |   |  |
| 1169 |                                                                                                                                          |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1170 | <b>Gamma GOF Test</b>                                                                                                                    |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1171 | A-D Test Statistic                                                                                                                       |   |        | 2.337                               | <b>Anderson-Darling Gamma GOF Test</b>              |   |       |       |   |   |   |  |
| 1172 | 5% A-D Critical Value                                                                                                                    |   |        | 0.803                               | Data Not Gamma Distributed at 5% Significance Level |   |       |       |   |   |   |  |
| 1173 | K-S Test Statistic                                                                                                                       |   |        | 0.199                               | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |       |       |   |   |   |  |
| 1174 | 5% K-S Critical Value                                                                                                                    |   |        | 0.148                               | Data Not Gamma Distributed at 5% Significance Level |   |       |       |   |   |   |  |
| 1175 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1176 |                                                                                                                                          |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1177 | <b>Gamma Statistics</b>                                                                                                                  |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1178 | k hat (MLE)                                                                                                                              |   | 0.604  | k star (bias corrected MLE)         |                                                     |   | 0.575 |       |   |   |   |  |
| 1179 | Theta hat (MLE)                                                                                                                          |   | 517.7  | Theta star (bias corrected MLE)     |                                                     |   | 544.1 |       |   |   |   |  |
| 1180 | nu hat (MLE)                                                                                                                             |   | 47.12  | nu star (bias corrected)            |                                                     |   | 44.83 |       |   |   |   |  |
| 1181 | MLE Mean (bias corrected)                                                                                                                |   | 312.7  | MLE Sd (bias corrected)             |                                                     |   | 412.5 |       |   |   |   |  |
| 1182 |                                                                                                                                          |   |        | Approximate Chi Square Value (0.05) |                                                     |   | 30.47 |       |   |   |   |  |
| 1183 | Adjusted Level of Significance                                                                                                           |   | 0.0437 | Adjusted Chi Square Value           |                                                     |   | 30    |       |   |   |   |  |
| 1184 |                                                                                                                                          |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1185 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1186 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |        | 460.1                               | 95% Adjusted Gamma UCL (use when n<50)              |   |       | 467.3 |   |   |   |  |
| 1187 |                                                                                                                                          |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1188 | <b>Lognormal GOF Test</b>                                                                                                                |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1189 | Shapiro Wilk Test Statistic                                                                                                              |   |        | 0.932                               | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |       |       |   |   |   |  |
| 1190 | 5% Shapiro Wilk Critical Value                                                                                                           |   |        | 0.939                               | Data Not Lognormal at 5% Significance Level         |   |       |       |   |   |   |  |
| 1191 | Lilliefors Test Statistic                                                                                                                |   |        | 0.145                               | <b>Lilliefors Lognormal GOF Test</b>                |   |       |       |   |   |   |  |
| 1192 | 5% Lilliefors Critical Value                                                                                                             |   |        | 0.14                                | Data Not Lognormal at 5% Significance Level         |   |       |       |   |   |   |  |
| 1193 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1194 |                                                                                                                                          |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1195 | <b>Lognormal Statistics</b>                                                                                                              |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1196 | Minimum of Logged Data                                                                                                                   |   |        | 2.632                               | Mean of logged Data                                 |   |       | 4.724 |   |   |   |  |
| 1197 | Maximum of Logged Data                                                                                                                   |   |        | 8.636                               | SD of logged Data                                   |   |       | 1.283 |   |   |   |  |
| 1198 |                                                                                                                                          |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1199 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1200 | 95% H-UCL                                                                                                                                |   | 454    | 90% Chebyshev (MVUE) UCL            |                                                     |   | 436.1 |       |   |   |   |  |
| 1201 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 521.6  | 97.5% Chebyshev (MVUE) UCL          |                                                     |   | 640.4 |       |   |   |   |  |
| 1202 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 873.8  |                                     |                                                     |   |       |       |   |   |   |  |
| 1203 |                                                                                                                                          |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1204 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1205 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |   |        |                                     |                                                     |   |       |       |   |   |   |  |
| 1206 |                                                                                                                                          |   |        |                                     |                                                     |   |       |       |   |   |   |  |

| A    | B                                                                                                                                        | C | D | E                                       | F                                                   | G | H | I     | J | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|-----------------------------------------|-----------------------------------------------------|---|---|-------|---|---|---|--|
| 1207 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1208 | 95% CLT UCL                                                                                                                              |   |   | 546.8                                   | 95% Jackknife UCL                                   |   |   | 552.7 |   |   |   |  |
| 1209 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 551.9                                   | 95% Bootstrap-t UCL                                 |   |   | 1383  |   |   |   |  |
| 1210 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 1438                                    | 95% Percentile Bootstrap UCL                        |   |   | 590.9 |   |   |   |  |
| 1211 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 751.9                                   |                                                     |   |   |       |   |   |   |  |
| 1212 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 739.7                                   | 95% Chebyshev(Mean, Sd) UCL                         |   |   | 933.1 |   |   |   |  |
| 1213 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 1202                                    | 99% Chebyshev(Mean, Sd) UCL                         |   |   | 1729  |   |   |   |  |
| 1214 |                                                                                                                                          |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1215 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1216 | 95% Chebyshev (Mean, Sd) UCL                                                                                                             |   |   | 933.1                                   |                                                     |   |   |       |   |   |   |  |
| 1217 |                                                                                                                                          |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1218 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1219 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1220 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1221 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1222 |                                                                                                                                          |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1223 |                                                                                                                                          |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1224 | <b>Result (eu7_iron)</b>                                                                                                                 |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1225 |                                                                                                                                          |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1226 | <b>General Statistics</b>                                                                                                                |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1227 | Total Number of Observations                                                                                                             |   |   | 39                                      | Number of Distinct Observations                     |   |   | 35    |   |   |   |  |
| 1228 |                                                                                                                                          |   |   |                                         | Number of Missing Observations                      |   |   | 0     |   |   |   |  |
| 1229 | Minimum                                                                                                                                  |   |   | 14400                                   | Mean                                                |   |   | 40900 |   |   |   |  |
| 1230 | Maximum                                                                                                                                  |   |   | 250000                                  | Median                                              |   |   | 27100 |   |   |   |  |
| 1231 | SD                                                                                                                                       |   |   | 41900                                   | Std. Error of Mean                                  |   |   | 6709  |   |   |   |  |
| 1232 | Coefficient of Variation                                                                                                                 |   |   | 1.024                                   | Skewness                                            |   |   | 3.666 |   |   |   |  |
| 1233 |                                                                                                                                          |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1234 | <b>Normal GOF Test</b>                                                                                                                   |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1235 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.564                                   | <b>Shapiro Wilk GOF Test</b>                        |   |   |       |   |   |   |  |
| 1236 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.939                                   | Data Not Normal at 5% Significance Level            |   |   |       |   |   |   |  |
| 1237 | Lilliefors Test Statistic                                                                                                                |   |   | 0.34                                    | <b>Lilliefors GOF Test</b>                          |   |   |       |   |   |   |  |
| 1238 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.14                                    | Data Not Normal at 5% Significance Level            |   |   |       |   |   |   |  |
| 1239 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1240 |                                                                                                                                          |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1241 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1242 | <b>95% Normal UCL</b>                                                                                                                    |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |                                                     |   |   |       |   |   |   |  |
| 1243 | 95% Student's-t UCL                                                                                                                      |   |   | 52212                                   | 95% Adjusted-CLT UCL (Chen-1995)                    |   |   | 56144 |   |   |   |  |
| 1244 |                                                                                                                                          |   |   |                                         | 95% Modified-t UCL (Johnson-1978)                   |   |   | 52868 |   |   |   |  |
| 1245 |                                                                                                                                          |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1246 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1247 | A-D Test Statistic                                                                                                                       |   |   | 3.519                                   | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |       |   |   |   |  |
| 1248 | 5% A-D Critical Value                                                                                                                    |   |   | 0.758                                   | Data Not Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |  |
| 1249 | K-S Test Statistic                                                                                                                       |   |   | 0.291                                   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |   |       |   |   |   |  |
| 1250 | 5% K-S Critical Value                                                                                                                    |   |   | 0.143                                   | Data Not Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |  |
| 1251 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1252 |                                                                                                                                          |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1253 | <b>Gamma Statistics</b>                                                                                                                  |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1254 | k hat (MLE)                                                                                                                              |   |   | 2.147                                   | k star (bias corrected MLE)                         |   |   | 1.998 |   |   |   |  |
| 1255 | Theta hat (MLE)                                                                                                                          |   |   | 19054                                   | Theta star (bias corrected MLE)                     |   |   | 20465 |   |   |   |  |
| 1256 | nu hat (MLE)                                                                                                                             |   |   | 167.4                                   | nu star (bias corrected)                            |   |   | 155.9 |   |   |   |  |
| 1257 | MLE Mean (bias corrected)                                                                                                                |   |   | 40900                                   | MLE Sd (bias corrected)                             |   |   | 28932 |   |   |   |  |
| 1258 |                                                                                                                                          |   |   |                                         | Approximate Chi Square Value (0.05)                 |   |   | 128   |   |   |   |  |
| 1259 | Adjusted Level of Significance                                                                                                           |   |   | 0.0437                                  | Adjusted Chi Square Value                           |   |   | 127   |   |   |   |  |
| 1260 |                                                                                                                                          |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1261 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1262 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   |   | 49801                                   | 95% Adjusted Gamma UCL (use when n<50)              |   |   | 50191 |   |   |   |  |
| 1263 |                                                                                                                                          |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1264 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1265 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.841                                   | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |   |       |   |   |   |  |
| 1266 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.939                                   | Data Not Lognormal at 5% Significance Level         |   |   |       |   |   |   |  |
| 1267 | Lilliefors Test Statistic                                                                                                                |   |   | 0.245                                   | <b>Lilliefors Lognormal GOF Test</b>                |   |   |       |   |   |   |  |
| 1268 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.14                                    | Data Not Lognormal at 5% Significance Level         |   |   |       |   |   |   |  |
| 1269 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1270 |                                                                                                                                          |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1271 | <b>Lognormal Statistics</b>                                                                                                              |   |   |                                         |                                                     |   |   |       |   |   |   |  |
| 1272 | Minimum of Logged Data                                                                                                                   |   |   | 9.575                                   | Mean of logged Data                                 |   |   | 10.37 |   |   |   |  |
| 1273 | Maximum of Logged Data                                                                                                                   |   |   | 12.43                                   | SD of logged Data                                   |   |   | 0.621 |   |   |   |  |

| A    | B                                                                                                                                        | C | D      | E                                                   | F | G      | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|-----------------------------------------------------|---|--------|---|---|---|---|---|
| 1274 |                                                                                                                                          |   |        |                                                     |   |        |   |   |   |   |   |
| 1275 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |        |                                                     |   |        |   |   |   |   |   |
| 1276 | 95% H-UCL                                                                                                                                |   | 47302  | 90% Chebyshev (MVUE) UCL                            |   | 50652  |   |   |   |   |   |
| 1277 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 56210  | 97.5% Chebyshev (MVUE) UCL                          |   | 63924  |   |   |   |   |   |
| 1278 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 79078  |                                                     |   |        |   |   |   |   |   |
| 1279 |                                                                                                                                          |   |        |                                                     |   |        |   |   |   |   |   |
| 1280 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |        |                                                     |   |        |   |   |   |   |   |
| 1281 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |   |        |                                                     |   |        |   |   |   |   |   |
| 1282 |                                                                                                                                          |   |        |                                                     |   |        |   |   |   |   |   |
| 1283 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |        |                                                     |   |        |   |   |   |   |   |
| 1284 | 95% CLT UCL                                                                                                                              |   | 51936  | 95% Jackknife UCL                                   |   | 52212  |   |   |   |   |   |
| 1285 | 95% Standard Bootstrap UCL                                                                                                               |   | 51451  | 95% Bootstrap-t UCL                                 |   | 62006  |   |   |   |   |   |
| 1286 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 93774  | 95% Percentile Bootstrap UCL                        |   | 52733  |   |   |   |   |   |
| 1287 | 95% BCA Bootstrap UCL                                                                                                                    |   | 57597  |                                                     |   |        |   |   |   |   |   |
| 1288 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 61028  | 95% Chebyshev(Mean, Sd) UCL                         |   | 70145  |   |   |   |   |   |
| 1289 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 82800  | 99% Chebyshev(Mean, Sd) UCL                         |   | 107657 |   |   |   |   |   |
| 1290 |                                                                                                                                          |   |        |                                                     |   |        |   |   |   |   |   |
| 1291 | <b>Suggested UCL to Use</b>                                                                                                              |   |        |                                                     |   |        |   |   |   |   |   |
| 1292 | 95% Chebyshev (Mean, Sd) UCL                                                                                                             |   | 70145  |                                                     |   |        |   |   |   |   |   |
| 1293 |                                                                                                                                          |   |        |                                                     |   |        |   |   |   |   |   |
| 1294 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |                                                     |   |        |   |   |   |   |   |
| 1295 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |                                                     |   |        |   |   |   |   |   |
| 1296 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |                                                     |   |        |   |   |   |   |   |
| 1297 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |                                                     |   |        |   |   |   |   |   |
| 1298 |                                                                                                                                          |   |        |                                                     |   |        |   |   |   |   |   |
| 1299 |                                                                                                                                          |   |        |                                                     |   |        |   |   |   |   |   |
| 1300 | <b>Result (eu7_lead)</b>                                                                                                                 |   |        |                                                     |   |        |   |   |   |   |   |
| 1301 |                                                                                                                                          |   |        |                                                     |   |        |   |   |   |   |   |
| 1302 | <b>General Statistics</b>                                                                                                                |   |        |                                                     |   |        |   |   |   |   |   |
| 1303 | Total Number of Observations                                                                                                             |   | 39     | Number of Distinct Observations                     |   | 39     |   |   |   |   |   |
| 1304 |                                                                                                                                          |   |        | Number of Missing Observations                      |   | 0      |   |   |   |   |   |
| 1305 | Minimum                                                                                                                                  |   | 9.4    | Mean                                                |   | 956.4  |   |   |   |   |   |
| 1306 | Maximum                                                                                                                                  |   | 4130   | Median                                              |   | 512    |   |   |   |   |   |
| 1307 | SD                                                                                                                                       |   | 1007   | Std. Error of Mean                                  |   | 161.3  |   |   |   |   |   |
| 1308 | Coefficient of Variation                                                                                                                 |   | 1.053  | Skewness                                            |   | 1.186  |   |   |   |   |   |
| 1309 |                                                                                                                                          |   |        |                                                     |   |        |   |   |   |   |   |
| 1310 | <b>Normal GOF Test</b>                                                                                                                   |   |        |                                                     |   |        |   |   |   |   |   |
| 1311 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.842  | <b>Shapiro Wilk GOF Test</b>                        |   |        |   |   |   |   |   |
| 1312 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.939  | Data Not Normal at 5% Significance Level            |   |        |   |   |   |   |   |
| 1313 | Lilliefors Test Statistic                                                                                                                |   | 0.183  | <b>Lilliefors GOF Test</b>                          |   |        |   |   |   |   |   |
| 1314 | 5% Lilliefors Critical Value                                                                                                             |   | 0.14   | Data Not Normal at 5% Significance Level            |   |        |   |   |   |   |   |
| 1315 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |        |                                                     |   |        |   |   |   |   |   |
| 1316 |                                                                                                                                          |   |        |                                                     |   |        |   |   |   |   |   |
| 1317 | <b>Assuming Normal Distribution</b>                                                                                                      |   |        |                                                     |   |        |   |   |   |   |   |
| 1318 | <b>95% Normal UCL</b>                                                                                                                    |   |        | <b>95% UCLs (Adjusted for Skewness)</b>             |   |        |   |   |   |   |   |
| 1319 | 95% Student's-t UCL                                                                                                                      |   | 1228   | 95% Adjusted-CLT UCL (Chen-1995)                    |   | 1254   |   |   |   |   |   |
| 1320 |                                                                                                                                          |   |        | 95% Modified-t UCL (Johnson-1978)                   |   | 1233   |   |   |   |   |   |
| 1321 |                                                                                                                                          |   |        |                                                     |   |        |   |   |   |   |   |
| 1322 | <b>Gamma GOF Test</b>                                                                                                                    |   |        |                                                     |   |        |   |   |   |   |   |
| 1323 | A-D Test Statistic                                                                                                                       |   | 1.033  | <b>Anderson-Darling Gamma GOF Test</b>              |   |        |   |   |   |   |   |
| 1324 | 5% A-D Critical Value                                                                                                                    |   | 0.799  | Data Not Gamma Distributed at 5% Significance Level |   |        |   |   |   |   |   |
| 1325 | K-S Test Statistic                                                                                                                       |   | 0.183  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |        |   |   |   |   |   |
| 1326 | 5% K-S Critical Value                                                                                                                    |   | 0.148  | Data Not Gamma Distributed at 5% Significance Level |   |        |   |   |   |   |   |
| 1327 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |        |                                                     |   |        |   |   |   |   |   |
| 1328 |                                                                                                                                          |   |        |                                                     |   |        |   |   |   |   |   |
| 1329 | <b>Gamma Statistics</b>                                                                                                                  |   |        |                                                     |   |        |   |   |   |   |   |
| 1330 | k hat (MLE)                                                                                                                              |   | 0.64   | k star (bias corrected MLE)                         |   | 0.608  |   |   |   |   |   |
| 1331 | Theta hat (MLE)                                                                                                                          |   | 1495   | Theta star (bias corrected MLE)                     |   | 1574   |   |   |   |   |   |
| 1332 | nu hat (MLE)                                                                                                                             |   | 49.9   | nu star (bias corrected)                            |   | 47.4   |   |   |   |   |   |
| 1333 | MLE Mean (bias corrected)                                                                                                                |   | 956.4  | MLE Sd (bias corrected)                             |   | 1227   |   |   |   |   |   |
| 1334 |                                                                                                                                          |   |        | Approximate Chi Square Value (0.05)                 |   | 32.6   |   |   |   |   |   |
| 1335 | Adjusted Level of Significance                                                                                                           |   | 0.0437 | Adjusted Chi Square Value                           |   | 32.11  |   |   |   |   |   |
| 1336 |                                                                                                                                          |   |        |                                                     |   |        |   |   |   |   |   |
| 1337 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |        |                                                     |   |        |   |   |   |   |   |
| 1338 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   | 1391   | 95% Adjusted Gamma UCL (use when n<50)              |   | 1412   |   |   |   |   |   |
| 1339 |                                                                                                                                          |   |        |                                                     |   |        |   |   |   |   |   |
| 1340 | <b>Lognormal GOF Test</b>                                                                                                                |   |        |                                                     |   |        |   |   |   |   |   |

| A    | B                                                                                                                                        | C | D     | E                                                               | F                                           | G     | H | I     | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|-------|-----------------------------------------------------------------|---------------------------------------------|-------|---|-------|---|---|---|
| 1341 | Shapiro Wilk Test Statistic                                                                                                              |   |       | 0.901                                                           | <b>Shapiro Wilk Lognormal GOF Test</b>      |       |   |       |   |   |   |
| 1342 | 5% Shapiro Wilk Critical Value                                                                                                           |   |       | 0.939                                                           | Data Not Lognormal at 5% Significance Level |       |   |       |   |   |   |
| 1343 | Lilliefors Test Statistic                                                                                                                |   |       | 0.192                                                           | <b>Lilliefors Lognormal GOF Test</b>        |       |   |       |   |   |   |
| 1344 | 5% Lilliefors Critical Value                                                                                                             |   |       | 0.14                                                            | Data Not Lognormal at 5% Significance Level |       |   |       |   |   |   |
| 1345 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1346 |                                                                                                                                          |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1347 | <b>Lognormal Statistics</b>                                                                                                              |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1348 | Minimum of Logged Data                                                                                                                   |   |       | 2.241                                                           | Mean of logged Data                         |       |   | 5.906 |   |   |   |
| 1349 | Maximum of Logged Data                                                                                                                   |   |       | 8.326                                                           | SD of logged Data                           |       |   | 1.734 |   |   |   |
| 1350 |                                                                                                                                          |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1351 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1352 | 95% H-UCL                                                                                                                                |   | 4265  | 90% Chebyshev (MVUE) UCL                                        |                                             | 3221  |   |       |   |   |   |
| 1353 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 3995  | 97.5% Chebyshev (MVUE) UCL                                      |                                             | 5068  |   |       |   |   |   |
| 1354 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 7177  |                                                                 |                                             |       |   |       |   |   |   |
| 1355 |                                                                                                                                          |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1356 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1357 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1358 |                                                                                                                                          |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1359 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1360 | 95% CLT UCL                                                                                                                              |   | 1222  | 95% Jackknife UCL                                               |                                             | 1228  |   |       |   |   |   |
| 1361 | 95% Standard Bootstrap UCL                                                                                                               |   | 1217  | 95% Bootstrap-t UCL                                             |                                             | 1268  |   |       |   |   |   |
| 1362 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 1262  | 95% Percentile Bootstrap UCL                                    |                                             | 1217  |   |       |   |   |   |
| 1363 | 95% BCA Bootstrap UCL                                                                                                                    |   | 1242  |                                                                 |                                             |       |   |       |   |   |   |
| 1364 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 1440  | 95% Chebyshev(Mean, Sd) UCL                                     |                                             | 1659  |   |       |   |   |   |
| 1365 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 1964  | 99% Chebyshev(Mean, Sd) UCL                                     |                                             | 2561  |   |       |   |   |   |
| 1366 |                                                                                                                                          |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1367 | <b>Suggested UCL to Use</b>                                                                                                              |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1368 | 95% Chebyshev (Mean, Sd) UCL                                                                                                             |   | 1659  |                                                                 |                                             |       |   |       |   |   |   |
| 1369 |                                                                                                                                          |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1370 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1371 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1372 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1373 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1374 |                                                                                                                                          |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1375 |                                                                                                                                          |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1376 | <b>Result (eu7_manganese)</b>                                                                                                            |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1377 |                                                                                                                                          |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1378 | <b>General Statistics</b>                                                                                                                |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1379 | Total Number of Observations                                                                                                             |   | 39    | Number of Distinct Observations                                 |                                             | 38    |   |       |   |   |   |
| 1380 |                                                                                                                                          |   |       | Number of Missing Observations                                  |                                             | 0     |   |       |   |   |   |
| 1381 | Minimum                                                                                                                                  |   | 349   | Mean                                                            |                                             | 5676  |   |       |   |   |   |
| 1382 | Maximum                                                                                                                                  |   | 42300 | Median                                                          |                                             | 4300  |   |       |   |   |   |
| 1383 | SD                                                                                                                                       |   | 7291  | Std. Error of Mean                                              |                                             | 1168  |   |       |   |   |   |
| 1384 | Coefficient of Variation                                                                                                                 |   | 1.285 | Skewness                                                        |                                             | 3.479 |   |       |   |   |   |
| 1385 |                                                                                                                                          |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1386 | <b>Normal GOF Test</b>                                                                                                                   |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1387 | Shapiro Wilk Test Statistic                                                                                                              |   |       | 0.655                                                           | <b>Shapiro Wilk GOF Test</b>                |       |   |       |   |   |   |
| 1388 | 5% Shapiro Wilk Critical Value                                                                                                           |   |       | 0.939                                                           | Data Not Normal at 5% Significance Level    |       |   |       |   |   |   |
| 1389 | Lilliefors Test Statistic                                                                                                                |   |       | 0.233                                                           | <b>Lilliefors GOF Test</b>                  |       |   |       |   |   |   |
| 1390 | 5% Lilliefors Critical Value                                                                                                             |   |       | 0.14                                                            | Data Not Normal at 5% Significance Level    |       |   |       |   |   |   |
| 1391 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1392 |                                                                                                                                          |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1393 | <b>Assuming Normal Distribution</b>                                                                                                      |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1394 | <b>95% Normal UCL</b>                                                                                                                    |   |       | <b>95% UCLs (Adjusted for Skewness)</b>                         |                                             |       |   |       |   |   |   |
| 1395 | 95% Student's-t UCL                                                                                                                      |   | 7644  | 95% Adjusted-CLT UCL (Chen-1995)                                |                                             | 8291  |   |       |   |   |   |
| 1396 |                                                                                                                                          |   |       | 95% Modified-t UCL (Johnson-1978)                               |                                             | 7753  |   |       |   |   |   |
| 1397 |                                                                                                                                          |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1398 | <b>Gamma GOF Test</b>                                                                                                                    |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1399 | A-D Test Statistic                                                                                                                       |   | 0.911 | <b>Anderson-Darling Gamma GOF Test</b>                          |                                             |       |   |       |   |   |   |
| 1400 | 5% A-D Critical Value                                                                                                                    |   | 0.785 | Data Not Gamma Distributed at 5% Significance Level             |                                             |       |   |       |   |   |   |
| 1401 | K-S Test Statistic                                                                                                                       |   | 0.13  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |                                             |       |   |       |   |   |   |
| 1402 | 5% K-S Critical Value                                                                                                                    |   | 0.146 | Detected data appear Gamma Distributed at 5% Significance Level |                                             |       |   |       |   |   |   |
| 1403 | <b>Detected data follow Appr. Gamma Distribution at 5% Significance Level</b>                                                            |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1404 |                                                                                                                                          |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1405 | <b>Gamma Statistics</b>                                                                                                                  |   |       |                                                                 |                                             |       |   |       |   |   |   |
| 1406 | k hat (MLE)                                                                                                                              |   | 0.837 | k star (bias corrected MLE)                                     |                                             | 0.79  |   |       |   |   |   |
| 1407 | Theta hat (MLE)                                                                                                                          |   | 6781  | Theta star (bias corrected MLE)                                 |                                             | 7187  |   |       |   |   |   |



| A    | B                                                                                                                         | C                                                   | D      | E | F                                                               | G      | H | I | J | K | L |
|------|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|--------|---|-----------------------------------------------------------------|--------|---|---|---|---|---|
| 1475 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1476 |                                                                                                                           | KM Mean                                             | 0.101  |   | KM Standard Error of Mean                                       | 0.0334 |   |   |   |   |   |
| 1477 |                                                                                                                           | KM SD                                               | 0.168  |   | 95% KM (BCA) UCL                                                | 0.168  |   |   |   |   |   |
| 1478 |                                                                                                                           | 95% KM (t) UCL                                      | 0.157  |   | 95% KM (Percentile Bootstrap) UCL                               | 0.161  |   |   |   |   |   |
| 1479 |                                                                                                                           | 95% KM (z) UCL                                      | 0.156  |   | 95% KM Bootstrap t UCL                                          | 0.158  |   |   |   |   |   |
| 1480 |                                                                                                                           | 90% KM Chebyshev UCL                                | 0.201  |   | 95% KM Chebyshev UCL                                            | 0.246  |   |   |   |   |   |
| 1481 |                                                                                                                           | 97.5% KM Chebyshev UCL                              | 0.309  |   | 99% KM Chebyshev UCL                                            | 0.433  |   |   |   |   |   |
| 1482 |                                                                                                                           |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1483 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1484 |                                                                                                                           | A-D Test Statistic                                  | 0.736  |   | <b>Anderson-Darling GOF Test</b>                                |        |   |   |   |   |   |
| 1485 |                                                                                                                           | 5% A-D Critical Value                               | 0.719  |   | Detected Data Not Gamma Distributed at 5% Significance Level    |        |   |   |   |   |   |
| 1486 |                                                                                                                           | K-S Test Statistic                                  | 0.292  |   | <b>Kolmogorov-Smirnov GOF</b>                                   |        |   |   |   |   |   |
| 1487 |                                                                                                                           | 5% K-S Critical Value                               | 0.295  |   | Detected data appear Gamma Distributed at 5% Significance Level |        |   |   |   |   |   |
| 1488 | <b>Detected data follow Appr. Gamma Distribution at 5% Significance Level</b>                                             |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1489 |                                                                                                                           |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1490 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1491 |                                                                                                                           | k hat (MLE)                                         | 4.471  |   | k star (bias corrected MLE)                                     | 2.878  |   |   |   |   |   |
| 1492 |                                                                                                                           | Theta hat (MLE)                                     | 0.075  |   | Theta star (bias corrected MLE)                                 | 0.117  |   |   |   |   |   |
| 1493 |                                                                                                                           | nu hat (MLE)                                        | 71.53  |   | nu star (bias corrected)                                        | 46.04  |   |   |   |   |   |
| 1494 |                                                                                                                           | Mean (detects)                                      | 0.336  |   |                                                                 |        |   |   |   |   |   |
| 1495 |                                                                                                                           |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1496 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1497 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1498 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1499 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1500 | This is especially true when the sample size is small.                                                                    |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1501 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1502 |                                                                                                                           | Minimum                                             | 0.01   |   | Mean                                                            | 0.0828 |   |   |   |   |   |
| 1503 |                                                                                                                           | Maximum                                             | 0.644  |   | Median                                                          | 0.01   |   |   |   |   |   |
| 1504 |                                                                                                                           | SD                                                  | 0.154  |   | CV                                                              | 1.86   |   |   |   |   |   |
| 1505 |                                                                                                                           | k hat (MLE)                                         | 0.513  |   | k star (bias corrected MLE)                                     | 0.491  |   |   |   |   |   |
| 1506 |                                                                                                                           | Theta hat (MLE)                                     | 0.161  |   | Theta star (bias corrected MLE)                                 | 0.169  |   |   |   |   |   |
| 1507 |                                                                                                                           | nu hat (MLE)                                        | 40     |   | nu star (bias corrected)                                        | 38.26  |   |   |   |   |   |
| 1508 |                                                                                                                           | Adjusted Level of Significance ( $\beta$ )          | 0.0437 |   |                                                                 |        |   |   |   |   |   |
| 1509 |                                                                                                                           | Approximate Chi Square Value (38.26, $\alpha$ )     | 25.1   |   | Adjusted Chi Square Value (38.26, $\beta$ )                     | 24.67  |   |   |   |   |   |
| 1510 |                                                                                                                           | 95% Gamma Approximate UCL (use when $n \geq 50$ )   | 0.126  |   | 95% Gamma Adjusted UCL (use when $n < 50$ )                     | 0.128  |   |   |   |   |   |
| 1511 |                                                                                                                           |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1512 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1513 |                                                                                                                           | Mean (KM)                                           | 0.101  |   | SD (KM)                                                         | 0.168  |   |   |   |   |   |
| 1514 |                                                                                                                           | Variance (KM)                                       | 0.0282 |   | SE of Mean (KM)                                                 | 0.0334 |   |   |   |   |   |
| 1515 |                                                                                                                           | k hat (KM)                                          | 0.36   |   | k star (KM)                                                     | 0.349  |   |   |   |   |   |
| 1516 |                                                                                                                           | nu hat (KM)                                         | 28.06  |   | nu star (KM)                                                    | 27.23  |   |   |   |   |   |
| 1517 |                                                                                                                           | theta hat (KM)                                      | 0.28   |   | theta star (KM)                                                 | 0.289  |   |   |   |   |   |
| 1518 |                                                                                                                           | 80% gamma percentile (KM)                           | 0.16   |   | 90% gamma percentile (KM)                                       | 0.291  |   |   |   |   |   |
| 1519 |                                                                                                                           | 95% gamma percentile (KM)                           | 0.439  |   | 99% gamma percentile (KM)                                       | 0.815  |   |   |   |   |   |
| 1520 |                                                                                                                           |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1521 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1522 |                                                                                                                           | Approximate Chi Square Value (27.23, $\alpha$ )     | 16.33  |   | Adjusted Chi Square Value (27.23, $\beta$ )                     | 16     |   |   |   |   |   |
| 1523 |                                                                                                                           | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ ) | 0.168  |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )                  | 0.172  |   |   |   |   |   |
| 1524 |                                                                                                                           |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1525 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1526 |                                                                                                                           | Shapiro Wilk Test Statistic                         | 0.847  |   | <b>Shapiro Wilk GOF Test</b>                                    |        |   |   |   |   |   |
| 1527 |                                                                                                                           | 5% Shapiro Wilk Critical Value                      | 0.818  |   | Detected Data appear Lognormal at 5% Significance Level         |        |   |   |   |   |   |
| 1528 |                                                                                                                           | Lilliefors Test Statistic                           | 0.266  |   | <b>Lilliefors GOF Test</b>                                      |        |   |   |   |   |   |
| 1529 |                                                                                                                           | 5% Lilliefors Critical Value                        | 0.283  |   | Detected Data appear Lognormal at 5% Significance Level         |        |   |   |   |   |   |
| 1530 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                            |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1531 |                                                                                                                           |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1532 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1533 |                                                                                                                           | Mean in Original Scale                              | 0.136  |   | Mean in Log Scale                                               | -2.255 |   |   |   |   |   |
| 1534 |                                                                                                                           | SD in Original Scale                                | 0.132  |   | SD in Log Scale                                                 | 0.646  |   |   |   |   |   |
| 1535 |                                                                                                                           | 95% t UCL (assumes normality of ROS data)           | 0.171  |   | 95% Percentile Bootstrap UCL                                    | 0.173  |   |   |   |   |   |
| 1536 |                                                                                                                           | 95% BCA Bootstrap UCL                               | 0.183  |   | 95% Bootstrap t UCL                                             | 0.199  |   |   |   |   |   |
| 1537 |                                                                                                                           | 95% H-UCL (Log ROS)                                 | 0.16   |   |                                                                 |        |   |   |   |   |   |
| 1538 |                                                                                                                           |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1539 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 1540 |                                                                                                                           | KM Mean (logged)                                    | -4.18  |   | KM Geo Mean                                                     | 0.0153 |   |   |   |   |   |
| 1541 |                                                                                                                           | KM SD (logged)                                      | 1.99   |   | 95% Critical H Value (KM-Log)                                   | 3.745  |   |   |   |   |   |

| A    | B                                                                                                                                        | C | D | E      | F                                                   | G                                       | H | I      | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------|-----------------------------------------|---|--------|---|---|---|
| 1542 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.425  | 95% H-UCL (KM -Log)                                 |                                         |   | 0.371  |   |   |   |
| 1543 | KM SD (logged)                                                                                                                           |   |   | 1.99   | 95% Critical H Value (KM-Log)                       |                                         |   | 3.745  |   |   |   |
| 1544 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.425  |                                                     |                                         |   |        |   |   |   |
| 1545 |                                                                                                                                          |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1546 | <b>DL/2 Statistics</b>                                                                                                                   |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1547 | <b>DL/2 Normal</b>                                                                                                                       |   |   |        |                                                     | <b>DL/2 Log-Transformed</b>             |   |        |   |   |   |
| 1548 | Mean in Original Scale                                                                                                                   |   |   | 0.277  | Mean in Log Scale                                   |                                         |   | -2.274 |   |   |   |
| 1549 | SD in Original Scale                                                                                                                     |   |   | 0.442  | SD in Log Scale                                     |                                         |   | 1.639  |   |   |   |
| 1550 | 95% t UCL (Assumes normality)                                                                                                            |   |   | 0.396  | 95% H-Stat UCL                                      |                                         |   | 0.932  |   |   |   |
| 1551 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1552 |                                                                                                                                          |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1553 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1554 | <b>Detected Data appear Approximate Gamma Distributed at 5% Significance Level</b>                                                       |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1555 |                                                                                                                                          |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1556 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1557 | 95% KM Adjusted Gamma UCL                                                                                                                |   |   | 0.172  | 95% GROS Adjusted Gamma UCL                         |                                         |   | 0.128  |   |   |   |
| 1558 |                                                                                                                                          |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1559 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                           |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1560 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                   |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1561 |                                                                                                                                          |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1562 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1563 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1564 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1565 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1566 |                                                                                                                                          |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1567 |                                                                                                                                          |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1568 | <b>Result (eu7_zinc)</b>                                                                                                                 |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1569 |                                                                                                                                          |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1570 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1571 | Total Number of Observations                                                                                                             |   |   | 39     | Number of Distinct Observations                     |                                         |   | 39     |   |   |   |
| 1572 |                                                                                                                                          |   |   |        | Number of Missing Observations                      |                                         |   | 0      |   |   |   |
| 1573 | Minimum                                                                                                                                  |   |   | 109    | Mean                                                |                                         |   | 2168   |   |   |   |
| 1574 | Maximum                                                                                                                                  |   |   | 37300  | Median                                              |                                         |   | 977    |   |   |   |
| 1575 | SD                                                                                                                                       |   |   | 5883   | Std. Error of Mean                                  |                                         |   | 942    |   |   |   |
| 1576 | Coefficient of Variation                                                                                                                 |   |   | 2.713  | Skewness                                            |                                         |   | 5.892  |   |   |   |
| 1577 |                                                                                                                                          |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1578 | <b>Normal GOF Test</b>                                                                                                                   |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1579 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.309  | <b>Shapiro Wilk GOF Test</b>                        |                                         |   |        |   |   |   |
| 1580 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.939  | Data Not Normal at 5% Significance Level            |                                         |   |        |   |   |   |
| 1581 | Lilliefors Test Statistic                                                                                                                |   |   | 0.363  | <b>Lilliefors GOF Test</b>                          |                                         |   |        |   |   |   |
| 1582 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.14   | Data Not Normal at 5% Significance Level            |                                         |   |        |   |   |   |
| 1583 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1584 |                                                                                                                                          |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1585 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1586 | <b>95% Normal UCL</b>                                                                                                                    |   |   |        |                                                     | <b>95% UCLs (Adjusted for Skewness)</b> |   |        |   |   |   |
| 1587 | 95% Student's-t UCL                                                                                                                      |   |   | 3757   | 95% Adjusted-CLT UCL (Chen-1995)                    |                                         |   | 4668   |   |   |   |
| 1588 |                                                                                                                                          |   |   |        | 95% Modified-t UCL (Johnson-1978)                   |                                         |   | 3905   |   |   |   |
| 1589 |                                                                                                                                          |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1590 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1591 | A-D Test Statistic                                                                                                                       |   |   | 1.951  | <b>Anderson-Darling Gamma GOF Test</b>              |                                         |   |        |   |   |   |
| 1592 | 5% A-D Critical Value                                                                                                                    |   |   | 0.8    | Data Not Gamma Distributed at 5% Significance Level |                                         |   |        |   |   |   |
| 1593 | K-S Test Statistic                                                                                                                       |   |   | 0.161  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |                                         |   |        |   |   |   |
| 1594 | 5% K-S Critical Value                                                                                                                    |   |   | 0.148  | Data Not Gamma Distributed at 5% Significance Level |                                         |   |        |   |   |   |
| 1595 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1596 |                                                                                                                                          |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1597 | <b>Gamma Statistics</b>                                                                                                                  |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1598 | k hat (MLE)                                                                                                                              |   |   | 0.633  | k star (bias corrected MLE)                         |                                         |   | 0.601  |   |   |   |
| 1599 | Theta hat (MLE)                                                                                                                          |   |   | 3426   | Theta star (bias corrected MLE)                     |                                         |   | 3606   |   |   |   |
| 1600 | nu hat (MLE)                                                                                                                             |   |   | 49.37  | nu star (bias corrected)                            |                                         |   | 46.9   |   |   |   |
| 1601 | MLE Mean (bias corrected)                                                                                                                |   |   | 2168   | MLE Sd (bias corrected)                             |                                         |   | 2796   |   |   |   |
| 1602 |                                                                                                                                          |   |   |        | Approximate Chi Square Value (0.05)                 |                                         |   | 32.19  |   |   |   |
| 1603 | Adjusted Level of Significance                                                                                                           |   |   | 0.0437 | Adjusted Chi Square Value                           |                                         |   | 31.71  |   |   |   |
| 1604 |                                                                                                                                          |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1605 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1606 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   |   | 3160   | 95% Adjusted Gamma UCL (use when n<50)              |                                         |   | 3208   |   |   |   |
| 1607 |                                                                                                                                          |   |   |        |                                                     |                                         |   |        |   |   |   |
| 1608 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |        |                                                     |                                         |   |        |   |   |   |

| A    | B                                                                                                                                        | C | D     | E                                                   | F                                              | G     | H | I     | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|-------|-----------------------------------------------------|------------------------------------------------|-------|---|-------|---|---|---|
| 1609 | Shapiro Wilk Test Statistic                                                                                                              |   |       | 0.945                                               | <b>Shapiro Wilk Lognormal GOF Test</b>         |       |   |       |   |   |   |
| 1610 | 5% Shapiro Wilk Critical Value                                                                                                           |   |       | 0.939                                               | Data appear Lognormal at 5% Significance Level |       |   |       |   |   |   |
| 1611 | Lilliefors Test Statistic                                                                                                                |   |       | 0.138                                               | <b>Lilliefors Lognormal GOF Test</b>           |       |   |       |   |   |   |
| 1612 | 5% Lilliefors Critical Value                                                                                                             |   |       | 0.14                                                | Data appear Lognormal at 5% Significance Level |       |   |       |   |   |   |
| 1613 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1614 |                                                                                                                                          |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1615 | <b>Lognormal Statistics</b>                                                                                                              |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1616 | Minimum of Logged Data                                                                                                                   |   |       | 4.691                                               | Mean of logged Data                            |       |   | 6.713 |   |   |   |
| 1617 | Maximum of Logged Data                                                                                                                   |   |       | 10.53                                               | SD of logged Data                              |       |   | 1.265 |   |   |   |
| 1618 |                                                                                                                                          |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1619 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1620 | 95% H-UCL                                                                                                                                |   | 3207  | 90% Chebyshev (MVUE) UCL                            |                                                | 3099  |   |       |   |   |   |
| 1621 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 3702  | 97.5% Chebyshev (MVUE) UCL                          |                                                | 4537  |   |       |   |   |   |
| 1622 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 6180  |                                                     |                                                |       |   |       |   |   |   |
| 1623 |                                                                                                                                          |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1624 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1625 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1626 |                                                                                                                                          |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1627 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1628 | 95% CLT UCL                                                                                                                              |   | 3718  | 95% Jackknife UCL                                   |                                                | 3757  |   |       |   |   |   |
| 1629 | 95% Standard Bootstrap UCL                                                                                                               |   | 3725  | 95% Bootstrap-t UCL                                 |                                                | 8730  |   |       |   |   |   |
| 1630 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 9742  | 95% Percentile Bootstrap UCL                        |                                                | 4031  |   |       |   |   |   |
| 1631 | 95% BCA Bootstrap UCL                                                                                                                    |   | 4997  |                                                     |                                                |       |   |       |   |   |   |
| 1632 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 4994  | 95% Chebyshev(Mean, Sd) UCL                         |                                                | 6275  |   |       |   |   |   |
| 1633 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 8051  | 99% Chebyshev(Mean, Sd) UCL                         |                                                | 11541 |   |       |   |   |   |
| 1634 |                                                                                                                                          |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1635 | <b>Suggested UCL to Use</b>                                                                                                              |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1636 | 95% H-UCL                                                                                                                                |   | 3207  |                                                     |                                                |       |   |       |   |   |   |
| 1637 |                                                                                                                                          |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1638 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1639 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1640 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1641 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1642 |                                                                                                                                          |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1643 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1644 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1645 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1646 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1647 |                                                                                                                                          |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1648 |                                                                                                                                          |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1649 | <b>Result (eu8_arsenic)</b>                                                                                                              |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1650 |                                                                                                                                          |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1651 | <b>General Statistics</b>                                                                                                                |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1652 | Total Number of Observations                                                                                                             |   |       | 65                                                  | Number of Distinct Observations                |       |   | 63    |   |   |   |
| 1653 |                                                                                                                                          |   |       |                                                     | Number of Missing Observations                 |       |   | 0     |   |   |   |
| 1654 | Minimum                                                                                                                                  |   | 8.3   | Mean                                                |                                                | 97.96 |   |       |   |   |   |
| 1655 | Maximum                                                                                                                                  |   | 448   | Median                                              |                                                | 54.5  |   |       |   |   |   |
| 1656 | SD                                                                                                                                       |   | 104.4 | Std. Error of Mean                                  |                                                | 12.94 |   |       |   |   |   |
| 1657 | Coefficient of Variation                                                                                                                 |   | 1.065 | Skewness                                            |                                                | 1.916 |   |       |   |   |   |
| 1658 |                                                                                                                                          |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1659 | <b>Normal GOF Test</b>                                                                                                                   |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1660 | Shapiro Wilk Test Statistic                                                                                                              |   |       | 0.718                                               | <b>Shapiro Wilk GOF Test</b>                   |       |   |       |   |   |   |
| 1661 | 5% Shapiro Wilk P Value                                                                                                                  |   |       | 1.110E-16                                           | Data Not Normal at 5% Significance Level       |       |   |       |   |   |   |
| 1662 | Lilliefors Test Statistic                                                                                                                |   |       | 0.254                                               | <b>Lilliefors GOF Test</b>                     |       |   |       |   |   |   |
| 1663 | 5% Lilliefors Critical Value                                                                                                             |   |       | 0.11                                                | Data Not Normal at 5% Significance Level       |       |   |       |   |   |   |
| 1664 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1665 |                                                                                                                                          |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1666 | <b>Assuming Normal Distribution</b>                                                                                                      |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1667 | <b>95% Normal UCL</b>                                                                                                                    |   |       | <b>95% UCLs (Adjusted for Skewness)</b>             |                                                |       |   |       |   |   |   |
| 1668 | 95% Student's-t UCL                                                                                                                      |   | 119.6 | 95% Adjusted-CLT UCL (Chen-1995)                    |                                                | 122.5 |   |       |   |   |   |
| 1669 |                                                                                                                                          |   |       | 95% Modified-t UCL (Johnson-1978)                   |                                                | 120.1 |   |       |   |   |   |
| 1670 |                                                                                                                                          |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1671 | <b>Gamma GOF Test</b>                                                                                                                    |   |       |                                                     |                                                |       |   |       |   |   |   |
| 1672 | A-D Test Statistic                                                                                                                       |   | 2.846 | <b>Anderson-Darling Gamma GOF Test</b>              |                                                |       |   |       |   |   |   |
| 1673 | 5% A-D Critical Value                                                                                                                    |   | 0.773 | Data Not Gamma Distributed at 5% Significance Level |                                                |       |   |       |   |   |   |
| 1674 | K-S Test Statistic                                                                                                                       |   | 0.176 | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |                                                |       |   |       |   |   |   |
| 1675 | 5% K-S Critical Value                                                                                                                    |   | 0.113 | Data Not Gamma Distributed at 5% Significance Level |                                                |       |   |       |   |   |   |

| A    | B                                                                                                                                        | C         | D | E                                           | F     | G | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|-----------|---|---------------------------------------------|-------|---|---|---|---|---|---|
| 1676 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |           |   |                                             |       |   |   |   |   |   |   |
| 1677 |                                                                                                                                          |           |   |                                             |       |   |   |   |   |   |   |
| 1678 | <b>Gamma Statistics</b>                                                                                                                  |           |   |                                             |       |   |   |   |   |   |   |
| 1679 | k hat (MLE)                                                                                                                              | 1.315     |   | k star (bias corrected MLE)                 | 1.264 |   |   |   |   |   |   |
| 1680 | Theta hat (MLE)                                                                                                                          | 74.51     |   | Theta star (bias corrected MLE)             | 77.48 |   |   |   |   |   |   |
| 1681 | nu hat (MLE)                                                                                                                             | 170.9     |   | nu star (bias corrected)                    | 164.4 |   |   |   |   |   |   |
| 1682 | MLE Mean (bias corrected)                                                                                                                | 97.96     |   | MLE Sd (bias corrected)                     | 87.12 |   |   |   |   |   |   |
| 1683 |                                                                                                                                          |           |   | Approximate Chi Square Value (0.05)         | 135.7 |   |   |   |   |   |   |
| 1684 | Adjusted Level of Significance                                                                                                           | 0.0463    |   | Adjusted Chi Square Value                   | 135.1 |   |   |   |   |   |   |
| 1685 |                                                                                                                                          |           |   |                                             |       |   |   |   |   |   |   |
| 1686 | <b>Assuming Gamma Distribution</b>                                                                                                       |           |   |                                             |       |   |   |   |   |   |   |
| 1687 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | 118.6     |   | 95% Adjusted Gamma UCL (use when n<50)      | 119.1 |   |   |   |   |   |   |
| 1688 |                                                                                                                                          |           |   |                                             |       |   |   |   |   |   |   |
| 1689 | <b>Lognormal GOF Test</b>                                                                                                                |           |   |                                             |       |   |   |   |   |   |   |
| 1690 | Shapiro Wilk Test Statistic                                                                                                              | 0.938     |   | <b>Shapiro Wilk Lognormal GOF Test</b>      |       |   |   |   |   |   |   |
| 1691 | 5% Shapiro Wilk P Value                                                                                                                  | 0.00423   |   | Data Not Lognormal at 5% Significance Level |       |   |   |   |   |   |   |
| 1692 | Lilliefors Test Statistic                                                                                                                | 0.121     |   | <b>Lilliefors Lognormal GOF Test</b>        |       |   |   |   |   |   |   |
| 1693 | 5% Lilliefors Critical Value                                                                                                             | 0.11      |   | Data Not Lognormal at 5% Significance Level |       |   |   |   |   |   |   |
| 1694 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |           |   |                                             |       |   |   |   |   |   |   |
| 1695 |                                                                                                                                          |           |   |                                             |       |   |   |   |   |   |   |
| 1696 | <b>Lognormal Statistics</b>                                                                                                              |           |   |                                             |       |   |   |   |   |   |   |
| 1697 | Minimum of Logged Data                                                                                                                   | 2.116     |   | Mean of logged Data                         | 4.158 |   |   |   |   |   |   |
| 1698 | Maximum of Logged Data                                                                                                                   | 6.105     |   | SD of logged Data                           | 0.893 |   |   |   |   |   |   |
| 1699 |                                                                                                                                          |           |   |                                             |       |   |   |   |   |   |   |
| 1700 | <b>Assuming Lognormal Distribution</b>                                                                                                   |           |   |                                             |       |   |   |   |   |   |   |
| 1701 | 95% H-UCL                                                                                                                                | 121.5     |   | 90% Chebyshev (MVUE) UCL                    | 130.6 |   |   |   |   |   |   |
| 1702 | 95% Chebyshev (MVUE) UCL                                                                                                                 | 147       |   | 97.5% Chebyshev (MVUE) UCL                  | 169.8 |   |   |   |   |   |   |
| 1703 | 99% Chebyshev (MVUE) UCL                                                                                                                 | 214.5     |   |                                             |       |   |   |   |   |   |   |
| 1704 |                                                                                                                                          |           |   |                                             |       |   |   |   |   |   |   |
| 1705 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |           |   |                                             |       |   |   |   |   |   |   |
| 1706 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |           |   |                                             |       |   |   |   |   |   |   |
| 1707 |                                                                                                                                          |           |   |                                             |       |   |   |   |   |   |   |
| 1708 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |           |   |                                             |       |   |   |   |   |   |   |
| 1709 | 95% CLT UCL                                                                                                                              | 119.2     |   | 95% Jackknife UCL                           | 119.6 |   |   |   |   |   |   |
| 1710 | 95% Standard Bootstrap UCL                                                                                                               | 119.2     |   | 95% Bootstrap-t UCL                         | 124.8 |   |   |   |   |   |   |
| 1711 | 95% Hall's Bootstrap UCL                                                                                                                 | 122.1     |   | 95% Percentile Bootstrap UCL                | 118.8 |   |   |   |   |   |   |
| 1712 | 95% BCA Bootstrap UCL                                                                                                                    | 120       |   |                                             |       |   |   |   |   |   |   |
| 1713 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              | 136.8     |   | 95% Chebyshev(Mean, Sd) UCL                 | 154.4 |   |   |   |   |   |   |
| 1714 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            | 178.8     |   | 99% Chebyshev(Mean, Sd) UCL                 | 226.7 |   |   |   |   |   |   |
| 1715 |                                                                                                                                          |           |   |                                             |       |   |   |   |   |   |   |
| 1716 | <b>Suggested UCL to Use</b>                                                                                                              |           |   |                                             |       |   |   |   |   |   |   |
| 1717 | 95% Chebyshev (Mean, Sd) UCL                                                                                                             | 154.4     |   |                                             |       |   |   |   |   |   |   |
| 1718 |                                                                                                                                          |           |   |                                             |       |   |   |   |   |   |   |
| 1719 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |           |   |                                             |       |   |   |   |   |   |   |
| 1720 | Recommendations are based upon data size, data distribution, and skewness.                                                               |           |   |                                             |       |   |   |   |   |   |   |
| 1721 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |           |   |                                             |       |   |   |   |   |   |   |
| 1722 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |           |   |                                             |       |   |   |   |   |   |   |
| 1723 |                                                                                                                                          |           |   |                                             |       |   |   |   |   |   |   |
| 1724 |                                                                                                                                          |           |   |                                             |       |   |   |   |   |   |   |
| 1725 | <b>Result (eu8_cadmium)</b>                                                                                                              |           |   |                                             |       |   |   |   |   |   |   |
| 1726 |                                                                                                                                          |           |   |                                             |       |   |   |   |   |   |   |
| 1727 | <b>General Statistics</b>                                                                                                                |           |   |                                             |       |   |   |   |   |   |   |
| 1728 | Total Number of Observations                                                                                                             | 65        |   | Number of Distinct Observations             | 59    |   |   |   |   |   |   |
| 1729 |                                                                                                                                          |           |   | Number of Missing Observations              | 0     |   |   |   |   |   |   |
| 1730 | Minimum                                                                                                                                  | 0.32      |   | Mean                                        | 3.098 |   |   |   |   |   |   |
| 1731 | Maximum                                                                                                                                  | 13.9      |   | Median                                      | 2.27  |   |   |   |   |   |   |
| 1732 | SD                                                                                                                                       | 2.877     |   | Std. Error of Mean                          | 0.357 |   |   |   |   |   |   |
| 1733 | Coefficient of Variation                                                                                                                 | 0.929     |   | Skewness                                    | 1.76  |   |   |   |   |   |   |
| 1734 |                                                                                                                                          |           |   |                                             |       |   |   |   |   |   |   |
| 1735 | <b>Normal GOF Test</b>                                                                                                                   |           |   |                                             |       |   |   |   |   |   |   |
| 1736 | Shapiro Wilk Test Statistic                                                                                                              | 0.811     |   | <b>Shapiro Wilk GOF Test</b>                |       |   |   |   |   |   |   |
| 1737 | 5% Shapiro Wilk P Value                                                                                                                  | 3.774E-11 |   | Data Not Normal at 5% Significance Level    |       |   |   |   |   |   |   |
| 1738 | Lilliefors Test Statistic                                                                                                                | 0.187     |   | <b>Lilliefors GOF Test</b>                  |       |   |   |   |   |   |   |
| 1739 | 5% Lilliefors Critical Value                                                                                                             | 0.11      |   | Data Not Normal at 5% Significance Level    |       |   |   |   |   |   |   |
| 1740 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |           |   |                                             |       |   |   |   |   |   |   |
| 1741 |                                                                                                                                          |           |   |                                             |       |   |   |   |   |   |   |
| 1742 | <b>Assuming Normal Distribution</b>                                                                                                      |           |   |                                             |       |   |   |   |   |   |   |

| A    | B                                                                                                                                        | C | D | E      | F | G                                                               | H | I | J | K      | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|---|-----------------------------------------------------------------|---|---|---|--------|---|--|
| 1743 | <b>95% Normal UCL</b>                                                                                                                    |   |   |        |   | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |   |        |   |  |
| 1744 | 95% Student's-t UCL                                                                                                                      |   |   | 3.694  |   | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |   | 3.769  |   |  |
| 1745 |                                                                                                                                          |   |   |        |   | 95% Modified-t UCL (Johnson-1978)                               |   |   |   | 3.707  |   |  |
| 1746 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1747 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1748 | A-D Test Statistic                                                                                                                       |   |   | 0.647  |   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |   |        |   |  |
| 1749 | 5% A-D Critical Value                                                                                                                    |   |   | 0.77   |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |        |   |  |
| 1750 | K-S Test Statistic                                                                                                                       |   |   | 0.0842 |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |   |        |   |  |
| 1751 | 5% K-S Critical Value                                                                                                                    |   |   | 0.113  |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |        |   |  |
| 1752 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1753 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1754 | <b>Gamma Statistics</b>                                                                                                                  |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1755 | k hat (MLE)                                                                                                                              |   |   | 1.43   |   | k star (bias corrected MLE)                                     |   |   |   | 1.374  |   |  |
| 1756 | Theta hat (MLE)                                                                                                                          |   |   | 2.167  |   | Theta star (bias corrected MLE)                                 |   |   |   | 2.255  |   |  |
| 1757 | nu hat (MLE)                                                                                                                             |   |   | 185.8  |   | nu star (bias corrected)                                        |   |   |   | 178.6  |   |  |
| 1758 | MLE Mean (bias corrected)                                                                                                                |   |   | 3.098  |   | MLE Sd (bias corrected)                                         |   |   |   | 2.643  |   |  |
| 1759 |                                                                                                                                          |   |   |        |   | Approximate Chi Square Value (0.05)                             |   |   |   | 148.7  |   |  |
| 1760 | Adjusted Level of Significance                                                                                                           |   |   | 0.0463 |   | Adjusted Chi Square Value                                       |   |   |   | 148.1  |   |  |
| 1761 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1762 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1763 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   |   | 3.722  |   | 95% Adjusted Gamma UCL (use when n<50)                          |   |   |   | 3.737  |   |  |
| 1764 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1765 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1766 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.972  |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |   |        |   |  |
| 1767 | 5% Shapiro Wilk P Value                                                                                                                  |   |   | 0.325  |   | Data appear Lognormal at 5% Significance Level                  |   |   |   |        |   |  |
| 1768 | Lilliefors Test Statistic                                                                                                                |   |   | 0.0741 |   | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |   |        |   |  |
| 1769 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.11   |   | Data appear Lognormal at 5% Significance Level                  |   |   |   |        |   |  |
| 1770 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1771 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1772 | <b>Lognormal Statistics</b>                                                                                                              |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1773 | Minimum of Logged Data                                                                                                                   |   |   | -1.139 |   | Mean of logged Data                                             |   |   |   | 0.742  |   |  |
| 1774 | Maximum of Logged Data                                                                                                                   |   |   | 2.632  |   | SD of logged Data                                               |   |   |   | 0.909  |   |  |
| 1775 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1776 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1777 | 95% H-UCL                                                                                                                                |   |   | 4.073  |   | 90% Chebyshev (MVUE) UCL                                        |   |   |   | 4.379  |   |  |
| 1778 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 4.938  |   | 97.5% Chebyshev (MVUE) UCL                                      |   |   |   | 5.713  |   |  |
| 1779 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 7.235  |   |                                                                 |   |   |   |        |   |  |
| 1780 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1781 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1782 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1783 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1784 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1785 | 95% CLT UCL                                                                                                                              |   |   | 3.685  |   | 95% Jackknife UCL                                               |   |   |   | 3.694  |   |  |
| 1786 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 3.678  |   | 95% Bootstrap-t UCL                                             |   |   |   | 3.812  |   |  |
| 1787 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 3.78   |   | 95% Percentile Bootstrap UCL                                    |   |   |   | 3.667  |   |  |
| 1788 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 3.75   |   |                                                                 |   |   |   |        |   |  |
| 1789 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 4.169  |   | 95% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 4.654  |   |  |
| 1790 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 5.327  |   | 99% Chebyshev(Mean, Sd) UCL                                     |   |   |   | 6.649  |   |  |
| 1791 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1792 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1793 | 95% Approximate Gamma UCL                                                                                                                |   |   | 3.722  |   |                                                                 |   |   |   |        |   |  |
| 1794 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1795 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1796 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1797 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1798 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1799 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1800 | <b>Result (eu8_chromium)</b>                                                                                                             |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1801 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1802 | <b>General Statistics</b>                                                                                                                |   |   |        |   |                                                                 |   |   |   |        |   |  |
| 1803 | Total Number of Observations                                                                                                             |   |   | 65     |   | Number of Distinct Observations                                 |   |   |   | 43     |   |  |
| 1804 | Number of Detects                                                                                                                        |   |   | 59     |   | Number of Non-Detects                                           |   |   |   | 6      |   |  |
| 1805 | Number of Distinct Detects                                                                                                               |   |   | 41     |   | Number of Distinct Non-Detects                                  |   |   |   | 3      |   |  |
| 1806 | Minimum Detect                                                                                                                           |   |   | 1.05   |   | Minimum Non-Detect                                              |   |   |   | 2.48   |   |  |
| 1807 | Maximum Detect                                                                                                                           |   |   | 7.8    |   | Maximum Non-Detect                                              |   |   |   | 2.5    |   |  |
| 1808 | Variance Detects                                                                                                                         |   |   | 1.212  |   | Percent Non-Detects                                             |   |   |   | 9.231% |   |  |
| 1809 | Mean Detects                                                                                                                             |   |   | 3.159  |   | SD Detects                                                      |   |   |   | 1.101  |   |  |

|      | A                                                                                                                         | B | C | D | E       | F                                                               | G | H | I | J     | K | L |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|---|---------|-----------------------------------------------------------------|---|---|---|-------|---|---|
| 1810 | Median Detects                                                                                                            |   |   |   | 3       | CV Detects                                                      |   |   |   | 0.348 |   |   |
| 1811 | Skewness Detects                                                                                                          |   |   |   | 1.345   | Kurtosis Detects                                                |   |   |   | 4.127 |   |   |
| 1812 | Mean of Logged Detects                                                                                                    |   |   |   | 1.094   | SD of Logged Detects                                            |   |   |   | 0.34  |   |   |
| 1813 |                                                                                                                           |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1814 | <b>Normal GOF Test on Detects Only</b>                                                                                    |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1815 | Shapiro Wilk Test Statistic                                                                                               |   |   |   | 0.927   | <b>Normal GOF Test on Detected Observations Only</b>            |   |   |   |       |   |   |
| 1816 | 5% Shapiro Wilk P Value                                                                                                   |   |   |   | 0.00163 | Detected Data Not Normal at 5% Significance Level               |   |   |   |       |   |   |
| 1817 | Lilliefors Test Statistic                                                                                                 |   |   |   | 0.11    | <b>Lilliefors GOF Test</b>                                      |   |   |   |       |   |   |
| 1818 | 5% Lilliefors Critical Value                                                                                              |   |   |   | 0.115   | Detected Data appear Normal at 5% Significance Level            |   |   |   |       |   |   |
| 1819 | <b>Detected Data appear Approximate Normal at 5% Significance Level</b>                                                   |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1820 |                                                                                                                           |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1821 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1822 | KM Mean                                                                                                                   |   |   |   | 3.054   | KM Standard Error of Mean                                       |   |   |   | 0.138 |   |   |
| 1823 | KM SD                                                                                                                     |   |   |   | 1.097   | 95% KM (BCA) UCL                                                |   |   |   | 3.296 |   |   |
| 1824 | 95% KM (t) UCL                                                                                                            |   |   |   | 3.284   | 95% KM (Percentile Bootstrap) UCL                               |   |   |   | 3.291 |   |   |
| 1825 | 95% KM (z) UCL                                                                                                            |   |   |   | 3.281   | 95% KM Bootstrap t UCL                                          |   |   |   | 3.309 |   |   |
| 1826 | 90% KM Chebyshev UCL                                                                                                      |   |   |   | 3.469   | 95% KM Chebyshev UCL                                            |   |   |   | 3.656 |   |   |
| 1827 | 97.5% KM Chebyshev UCL                                                                                                    |   |   |   | 3.917   | 99% KM Chebyshev UCL                                            |   |   |   | 4.429 |   |   |
| 1828 |                                                                                                                           |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1829 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1830 | A-D Test Statistic                                                                                                        |   |   |   | 0.384   | <b>Anderson-Darling GOF Test</b>                                |   |   |   |       |   |   |
| 1831 | 5% A-D Critical Value                                                                                                     |   |   |   | 0.751   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |       |   |   |
| 1832 | K-S Test Statistic                                                                                                        |   |   |   | 0.077   | <b>Kolmogorov-Smirnov GOF</b>                                   |   |   |   |       |   |   |
| 1833 | 5% K-S Critical Value                                                                                                     |   |   |   | 0.116   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |       |   |   |
| 1834 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                    |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1835 |                                                                                                                           |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1836 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1837 | k hat (MLE)                                                                                                               |   |   |   | 9.08    | k star (bias corrected MLE)                                     |   |   |   | 8.63  |   |   |
| 1838 | Theta hat (MLE)                                                                                                           |   |   |   | 0.348   | Theta star (bias corrected MLE)                                 |   |   |   | 0.366 |   |   |
| 1839 | nu hat (MLE)                                                                                                              |   |   |   | 1071    | nu star (bias corrected)                                        |   |   |   | 1018  |   |   |
| 1840 | Mean (detects)                                                                                                            |   |   |   | 3.159   |                                                                 |   |   |   |       |   |   |
| 1841 |                                                                                                                           |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1842 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1843 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1844 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1845 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1846 | This is especially true when the sample size is small.                                                                    |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1847 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1848 | Minimum                                                                                                                   |   |   |   | 1.05    | Mean                                                            |   |   |   | 3.045 |   |   |
| 1849 | Maximum                                                                                                                   |   |   |   | 7.8     | Median                                                          |   |   |   | 2.8   |   |   |
| 1850 | SD                                                                                                                        |   |   |   | 1.11    | CV                                                              |   |   |   | 0.364 |   |   |
| 1851 | k hat (MLE)                                                                                                               |   |   |   | 8.437   | k star (bias corrected MLE)                                     |   |   |   | 8.058 |   |   |
| 1852 | Theta hat (MLE)                                                                                                           |   |   |   | 0.361   | Theta star (bias corrected MLE)                                 |   |   |   | 0.378 |   |   |
| 1853 | nu hat (MLE)                                                                                                              |   |   |   | 1097    | nu star (bias corrected)                                        |   |   |   | 1048  |   |   |
| 1854 | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   |   | 0.0463  |                                                                 |   |   |   |       |   |   |
| 1855 | Approximate Chi Square Value (N/A, $\alpha$ )                                                                             |   |   |   | 973.4   | Adjusted Chi Square Value (N/A, $\beta$ )                       |   |   |   | 971.8 |   |   |
| 1856 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   |   | 3.277   | 95% Gamma Adjusted UCL (use when $n < 50$ )                     |   |   |   | 3.282 |   |   |
| 1857 |                                                                                                                           |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1858 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1859 | Mean (KM)                                                                                                                 |   |   |   | 3.054   | SD (KM)                                                         |   |   |   | 1.097 |   |   |
| 1860 | Variance (KM)                                                                                                             |   |   |   | 1.203   | SE of Mean (KM)                                                 |   |   |   | 0.138 |   |   |
| 1861 | k hat (KM)                                                                                                                |   |   |   | 7.75    | k star (KM)                                                     |   |   |   | 7.403 |   |   |
| 1862 | nu hat (KM)                                                                                                               |   |   |   | 1008    | nu star (KM)                                                    |   |   |   | 962.4 |   |   |
| 1863 | theta hat (KM)                                                                                                            |   |   |   | 0.394   | theta star (KM)                                                 |   |   |   | 0.413 |   |   |
| 1864 | 80% gamma percentile (KM)                                                                                                 |   |   |   | 3.936   | 90% gamma percentile (KM)                                       |   |   |   | 4.551 |   |   |
| 1865 | 95% gamma percentile (KM)                                                                                                 |   |   |   | 5.103   | 99% gamma percentile (KM)                                       |   |   |   | 6.249 |   |   |
| 1866 |                                                                                                                           |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1867 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1868 | Approximate Chi Square Value (962.36, $\alpha$ )                                                                          |   |   |   | 891.3   | Adjusted Chi Square Value (962.36, $\beta$ )                    |   |   |   | 889.8 |   |   |
| 1869 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   |   |   | 3.297   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )                  |   |   |   | 3.303 |   |   |
| 1870 |                                                                                                                           |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1871 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |   |         |                                                                 |   |   |   |       |   |   |
| 1872 | Shapiro Wilk Approximate Test Statistic                                                                                   |   |   |   | 0.988   | <b>Shapiro Wilk GOF Test</b>                                    |   |   |   |       |   |   |
| 1873 | 5% Shapiro Wilk P Value                                                                                                   |   |   |   | 0.941   | Detected Data appear Lognormal at 5% Significance Level         |   |   |   |       |   |   |
| 1874 | Lilliefors Test Statistic                                                                                                 |   |   |   | 0.0735  | <b>Lilliefors GOF Test</b>                                      |   |   |   |       |   |   |
| 1875 | 5% Lilliefors Critical Value                                                                                              |   |   |   | 0.115   | Detected Data appear Lognormal at 5% Significance Level         |   |   |   |       |   |   |
| 1876 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                            |   |   |   |         |                                                                 |   |   |   |       |   |   |

| A    | B                                                                                                                                       | C | D | E      | F                                                             | G                                       | H | I     | J | K | L |  |
|------|-----------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|---------------------------------------------------------------|-----------------------------------------|---|-------|---|---|---|--|
| 1877 |                                                                                                                                         |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1878 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                               |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1879 | Mean in Original Scale                                                                                                                  |   |   | 3.051  | Mean in Log Scale                                             |                                         |   | 1.056 |   |   |   |  |
| 1880 | SD in Original Scale                                                                                                                    |   |   | 1.103  | SD in Log Scale                                               |                                         |   | 0.346 |   |   |   |  |
| 1881 | 95% t UCL (assumes normality of ROS data)                                                                                               |   |   | 3.28   | 95% Percentile Bootstrap UCL                                  |                                         |   | 3.289 |   |   |   |  |
| 1882 | 95% BCA Bootstrap UCL                                                                                                                   |   |   | 3.291  | 95% Bootstrap t UCL                                           |                                         |   | 3.305 |   |   |   |  |
| 1883 | 95% H-UCL (Log ROS)                                                                                                                     |   |   | 3.297  |                                                               |                                         |   |       |   |   |   |  |
| 1884 |                                                                                                                                         |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1885 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                 |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1886 | KM Mean (logged)                                                                                                                        |   |   | 1.056  | KM Geo Mean                                                   |                                         |   | 2.875 |   |   |   |  |
| 1887 | KM SD (logged)                                                                                                                          |   |   | 0.349  | 95% Critical H Value (KM-Log)                                 |                                         |   | 1.778 |   |   |   |  |
| 1888 | KM Standard Error of Mean (logged)                                                                                                      |   |   | 0.0447 | 95% H-UCL (KM -Log)                                           |                                         |   | 3.302 |   |   |   |  |
| 1889 | KM SD (logged)                                                                                                                          |   |   | 0.349  | 95% Critical H Value (KM-Log)                                 |                                         |   | 1.778 |   |   |   |  |
| 1890 | KM Standard Error of Mean (logged)                                                                                                      |   |   | 0.0447 |                                                               |                                         |   |       |   |   |   |  |
| 1891 |                                                                                                                                         |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1892 | <b>DL/2 Statistics</b>                                                                                                                  |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1893 | <b>DL/2 Normal</b>                                                                                                                      |   |   |        |                                                               | <b>DL/2 Log-Transformed</b>             |   |       |   |   |   |  |
| 1894 | Mean in Original Scale                                                                                                                  |   |   | 2.982  | Mean in Log Scale                                             |                                         |   | 1.013 |   |   |   |  |
| 1895 | SD in Original Scale                                                                                                                    |   |   | 1.187  | SD in Log Scale                                               |                                         |   | 0.412 |   |   |   |  |
| 1896 | 95% t UCL (Assumes normality)                                                                                                           |   |   | 3.228  | 95% H-Stat UCL                                                |                                         |   | 3.292 |   |   |   |  |
| 1897 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1898 |                                                                                                                                         |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1899 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                   |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1900 | <b>Detected Data appear Approximate Normal Distributed at 5% Significance Level</b>                                                     |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1901 |                                                                                                                                         |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1902 | <b>Suggested UCL to Use</b>                                                                                                             |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1903 | 95% KM (t) UCL                                                                                                                          |   |   | 3.284  |                                                               |                                         |   |       |   |   |   |  |
| 1904 |                                                                                                                                         |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1905 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                          |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1906 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                  |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1907 |                                                                                                                                         |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1908 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.            |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1909 | Recommendations are based upon data size, data distribution, and skewness.                                                              |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1910 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1911 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statisticia |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1912 |                                                                                                                                         |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1913 |                                                                                                                                         |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1914 | <b>Result (eu8_cobalt)</b>                                                                                                              |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1915 |                                                                                                                                         |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1916 | <b>General Statistics</b>                                                                                                               |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1917 | Total Number of Observations                                                                                                            |   |   | 42     | Number of Distinct Observations                               |                                         |   | 36    |   |   |   |  |
| 1918 |                                                                                                                                         |   |   |        | Number of Missing Observations                                |                                         |   | 0     |   |   |   |  |
| 1919 | Minimum                                                                                                                                 |   |   | 4.2    | Mean                                                          |                                         |   | 15.6  |   |   |   |  |
| 1920 | Maximum                                                                                                                                 |   |   | 52.3   | Median                                                        |                                         |   | 13.25 |   |   |   |  |
| 1921 | SD                                                                                                                                      |   |   | 8.889  | Std. Error of Mean                                            |                                         |   | 1.372 |   |   |   |  |
| 1922 | Coefficient of Variation                                                                                                                |   |   | 0.57   | Skewness                                                      |                                         |   | 1.989 |   |   |   |  |
| 1923 |                                                                                                                                         |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1924 | <b>Normal GOF Test</b>                                                                                                                  |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1925 | Shapiro Wilk Test Statistic                                                                                                             |   |   | 0.817  | <b>Shapiro Wilk GOF Test</b>                                  |                                         |   |       |   |   |   |  |
| 1926 | 5% Shapiro Wilk Critical Value                                                                                                          |   |   | 0.942  | Data Not Normal at 5% Significance Level                      |                                         |   |       |   |   |   |  |
| 1927 | Lilliefors Test Statistic                                                                                                               |   |   | 0.141  | <b>Lilliefors GOF Test</b>                                    |                                         |   |       |   |   |   |  |
| 1928 | 5% Lilliefors Critical Value                                                                                                            |   |   | 0.135  | Data Not Normal at 5% Significance Level                      |                                         |   |       |   |   |   |  |
| 1929 | <b>Data Not Normal at 5% Significance Level</b>                                                                                         |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1930 |                                                                                                                                         |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1931 | <b>Assuming Normal Distribution</b>                                                                                                     |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1932 | <b>95% Normal UCL</b>                                                                                                                   |   |   |        |                                                               | <b>95% UCLs (Adjusted for Skewness)</b> |   |       |   |   |   |  |
| 1933 | 95% Student's-t UCL                                                                                                                     |   |   | 17.91  | 95% Adjusted-CLT UCL (Chen-1995)                              |                                         |   | 18.3  |   |   |   |  |
| 1934 |                                                                                                                                         |   |   |        | 95% Modified-t UCL (Johnson-1978)                             |                                         |   | 17.98 |   |   |   |  |
| 1935 |                                                                                                                                         |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1936 | <b>Gamma GOF Test</b>                                                                                                                   |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1937 | A-D Test Statistic                                                                                                                      |   |   | 0.369  | <b>Anderson-Darling Gamma GOF Test</b>                        |                                         |   |       |   |   |   |  |
| 1938 | 5% A-D Critical Value                                                                                                                   |   |   | 0.753  | Detected data appear Gamma Distributed at 5% Significance Lev |                                         |   |       |   |   |   |  |
| 1939 | K-S Test Statistic                                                                                                                      |   |   | 0.091  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                      |                                         |   |       |   |   |   |  |
| 1940 | 5% K-S Critical Value                                                                                                                   |   |   | 0.137  | Detected data appear Gamma Distributed at 5% Significance Lev |                                         |   |       |   |   |   |  |
| 1941 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                  |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1942 |                                                                                                                                         |   |   |        |                                                               |                                         |   |       |   |   |   |  |
| 1943 | <b>Gamma Statistics</b>                                                                                                                 |   |   |        |                                                               |                                         |   |       |   |   |   |  |

|      | A | B | C | D | E                                                                                                                                        | F         | G | H | I | J | K                                              | L     |  |
|------|---|---|---|---|------------------------------------------------------------------------------------------------------------------------------------------|-----------|---|---|---|---|------------------------------------------------|-------|--|
| 1944 |   |   |   |   | k hat (MLE)                                                                                                                              | 3.936     |   |   |   |   | k star (bias corrected MLE)                    | 3.67  |  |
| 1945 |   |   |   |   | Theta hat (MLE)                                                                                                                          | 3.963     |   |   |   |   | Theta star (bias corrected MLE)                | 4.25  |  |
| 1946 |   |   |   |   | nu hat (MLE)                                                                                                                             | 330.6     |   |   |   |   | nu star (bias corrected)                       | 308.3 |  |
| 1947 |   |   |   |   | MLE Mean (bias corrected)                                                                                                                | 15.6      |   |   |   |   | MLE Sd (bias corrected)                        | 8.141 |  |
| 1948 |   |   |   |   |                                                                                                                                          |           |   |   |   |   | Approximate Chi Square Value (0.05)            | 268.6 |  |
| 1949 |   |   |   |   | Adjusted Level of Significance                                                                                                           | 0.0443    |   |   |   |   | Adjusted Chi Square Value                      | 267.3 |  |
| 1950 |   |   |   |   |                                                                                                                                          |           |   |   |   |   |                                                |       |  |
| 1951 |   |   |   |   | <b>Assuming Gamma Distribution</b>                                                                                                       |           |   |   |   |   |                                                |       |  |
| 1952 |   |   |   |   | 95% Approximate Gamma UCL (use when n>=50)                                                                                               | 17.9      |   |   |   |   | 95% Adjusted Gamma UCL (use when n<50)         | 17.99 |  |
| 1953 |   |   |   |   |                                                                                                                                          |           |   |   |   |   |                                                |       |  |
| 1954 |   |   |   |   | <b>Lognormal GOF Test</b>                                                                                                                |           |   |   |   |   |                                                |       |  |
| 1955 |   |   |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.945     |   |   |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>         |       |  |
| 1956 |   |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                           | 0.942     |   |   |   |   | Data appear Lognormal at 5% Significance Level |       |  |
| 1957 |   |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.0658    |   |   |   |   | <b>Lilliefors Lognormal GOF Test</b>           |       |  |
| 1958 |   |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.135     |   |   |   |   | Data appear Lognormal at 5% Significance Level |       |  |
| 1959 |   |   |   |   | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |           |   |   |   |   |                                                |       |  |
| 1960 |   |   |   |   |                                                                                                                                          |           |   |   |   |   |                                                |       |  |
| 1961 |   |   |   |   | <b>Lognormal Statistics</b>                                                                                                              |           |   |   |   |   |                                                |       |  |
| 1962 |   |   |   |   | Minimum of Logged Data                                                                                                                   | 1.435     |   |   |   |   | Mean of logged Data                            | 2.615 |  |
| 1963 |   |   |   |   | Maximum of Logged Data                                                                                                                   | 3.957     |   |   |   |   | SD of logged Data                              | 0.515 |  |
| 1964 |   |   |   |   |                                                                                                                                          |           |   |   |   |   |                                                |       |  |
| 1965 |   |   |   |   | <b>Assuming Lognormal Distribution</b>                                                                                                   |           |   |   |   |   |                                                |       |  |
| 1966 |   |   |   |   | 95% H-UCL                                                                                                                                | 18.2      |   |   |   |   | 90% Chebyshev (MVUE) UCL                       | 19.45 |  |
| 1967 |   |   |   |   | 95% Chebyshev (MVUE) UCL                                                                                                                 | 21.21     |   |   |   |   | 97.5% Chebyshev (MVUE) UCL                     | 23.67 |  |
| 1968 |   |   |   |   | 99% Chebyshev (MVUE) UCL                                                                                                                 | 28.48     |   |   |   |   |                                                |       |  |
| 1969 |   |   |   |   |                                                                                                                                          |           |   |   |   |   |                                                |       |  |
| 1970 |   |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |           |   |   |   |   |                                                |       |  |
| 1971 |   |   |   |   | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |           |   |   |   |   |                                                |       |  |
| 1972 |   |   |   |   |                                                                                                                                          |           |   |   |   |   |                                                |       |  |
| 1973 |   |   |   |   | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |           |   |   |   |   |                                                |       |  |
| 1974 |   |   |   |   | 95% CLT UCL                                                                                                                              | 17.85     |   |   |   |   | 95% Jackknife UCL                              | 17.91 |  |
| 1975 |   |   |   |   | 95% Standard Bootstrap UCL                                                                                                               | 17.83     |   |   |   |   | 95% Bootstrap-t UCL                            | 18.74 |  |
| 1976 |   |   |   |   | 95% Hall's Bootstrap UCL                                                                                                                 | 19.16     |   |   |   |   | 95% Percentile Bootstrap UCL                   | 18.04 |  |
| 1977 |   |   |   |   | 95% BCA Bootstrap UCL                                                                                                                    | 18.48     |   |   |   |   |                                                |       |  |
| 1978 |   |   |   |   | 90% Chebyshev(Mean, Sd) UCL                                                                                                              | 19.71     |   |   |   |   | 95% Chebyshev(Mean, Sd) UCL                    | 21.58 |  |
| 1979 |   |   |   |   | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            | 24.16     |   |   |   |   | 99% Chebyshev(Mean, Sd) UCL                    | 29.25 |  |
| 1980 |   |   |   |   |                                                                                                                                          |           |   |   |   |   |                                                |       |  |
| 1981 |   |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |           |   |   |   |   |                                                |       |  |
| 1982 |   |   |   |   | 95% Adjusted Gamma UCL                                                                                                                   | 17.99     |   |   |   |   |                                                |       |  |
| 1983 |   |   |   |   |                                                                                                                                          |           |   |   |   |   |                                                |       |  |
| 1984 |   |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |           |   |   |   |   |                                                |       |  |
| 1985 |   |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |           |   |   |   |   |                                                |       |  |
| 1986 |   |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |           |   |   |   |   |                                                |       |  |
| 1987 |   |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |           |   |   |   |   |                                                |       |  |
| 1988 |   |   |   |   |                                                                                                                                          |           |   |   |   |   |                                                |       |  |
| 1989 |   |   |   |   |                                                                                                                                          |           |   |   |   |   |                                                |       |  |
| 1990 |   |   |   |   | <b>Result (eu8_copper)</b>                                                                                                               |           |   |   |   |   |                                                |       |  |
| 1991 |   |   |   |   |                                                                                                                                          |           |   |   |   |   |                                                |       |  |
| 1992 |   |   |   |   | <b>General Statistics</b>                                                                                                                |           |   |   |   |   |                                                |       |  |
| 1993 |   |   |   |   | Total Number of Observations                                                                                                             | 65        |   |   |   |   | Number of Distinct Observations                | 62    |  |
| 1994 |   |   |   |   |                                                                                                                                          |           |   |   |   |   | Number of Missing Observations                 | 0     |  |
| 1995 |   |   |   |   | Minimum                                                                                                                                  | 19        |   |   |   |   | Mean                                           | 211.6 |  |
| 1996 |   |   |   |   | Maximum                                                                                                                                  | 1010      |   |   |   |   | Median                                         | 142   |  |
| 1997 |   |   |   |   | SD                                                                                                                                       | 205.6     |   |   |   |   | Std. Error of Mean                             | 25.51 |  |
| 1998 |   |   |   |   | Coefficient of Variation                                                                                                                 | 0.972     |   |   |   |   | Skewness                                       | 2.095 |  |
| 1999 |   |   |   |   |                                                                                                                                          |           |   |   |   |   |                                                |       |  |
| 2000 |   |   |   |   | <b>Normal GOF Test</b>                                                                                                                   |           |   |   |   |   |                                                |       |  |
| 2001 |   |   |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.741     |   |   |   |   | <b>Shapiro Wilk GOF Test</b>                   |       |  |
| 2002 |   |   |   |   | 5% Shapiro Wilk P Value                                                                                                                  | 3.109E-15 |   |   |   |   | Data Not Normal at 5% Significance Level       |       |  |
| 2003 |   |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.22      |   |   |   |   | <b>Lilliefors GOF Test</b>                     |       |  |
| 2004 |   |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.11      |   |   |   |   | Data Not Normal at 5% Significance Level       |       |  |
| 2005 |   |   |   |   | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |           |   |   |   |   |                                                |       |  |
| 2006 |   |   |   |   |                                                                                                                                          |           |   |   |   |   |                                                |       |  |
| 2007 |   |   |   |   | <b>Assuming Normal Distribution</b>                                                                                                      |           |   |   |   |   |                                                |       |  |
| 2008 |   |   |   |   | <b>95% Normal UCL</b>                                                                                                                    |           |   |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b>        |       |  |
| 2009 |   |   |   |   | 95% Student's-t UCL                                                                                                                      | 254.2     |   |   |   |   | 95% Adjusted-CLT UCL (Chen-1995)               | 260.7 |  |
| 2010 |   |   |   |   |                                                                                                                                          |           |   |   |   |   | 95% Modified-t UCL (Johnson-1978)              | 255.3 |  |

|      | A                                                                                                                                        | B                              | C      | D                                                   | E     | F | G | H                                   | I     | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|--------|-----------------------------------------------------|-------|---|---|-------------------------------------|-------|---|---|---|
| 2011 |                                                                                                                                          |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2012 | <b>Gamma GOF Test</b>                                                                                                                    |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2013 |                                                                                                                                          | A-D Test Statistic             | 1.644  | <b>Anderson-Darling Gamma GOF Test</b>              |       |   |   |                                     |       |   |   |   |
| 2014 |                                                                                                                                          | 5% A-D Critical Value          | 0.768  | Data Not Gamma Distributed at 5% Significance Level |       |   |   |                                     |       |   |   |   |
| 2015 |                                                                                                                                          | K-S Test Statistic             | 0.115  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |       |   |   |                                     |       |   |   |   |
| 2016 |                                                                                                                                          | 5% K-S Critical Value          | 0.113  | Data Not Gamma Distributed at 5% Significance Level |       |   |   |                                     |       |   |   |   |
| 2017 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2018 |                                                                                                                                          |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2019 | <b>Gamma Statistics</b>                                                                                                                  |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2020 |                                                                                                                                          | k hat (MLE)                    | 1.582  |                                                     |       |   |   | k star (bias corrected MLE)         | 1.52  |   |   |   |
| 2021 |                                                                                                                                          | Theta hat (MLE)                | 133.7  |                                                     |       |   |   | Theta star (bias corrected MLE)     | 139.3 |   |   |   |
| 2022 |                                                                                                                                          | nu hat (MLE)                   | 205.7  |                                                     |       |   |   | nu star (bias corrected)            | 197.6 |   |   |   |
| 2023 |                                                                                                                                          | MLE Mean (bias corrected)      | 211.6  |                                                     |       |   |   | MLE Sd (bias corrected)             | 171.7 |   |   |   |
| 2024 |                                                                                                                                          |                                |        |                                                     |       |   |   | Approximate Chi Square Value (0.05) | 166   |   |   |   |
| 2025 |                                                                                                                                          | Adjusted Level of Significance | 0.0463 |                                                     |       |   |   | Adjusted Chi Square Value           | 165.4 |   |   |   |
| 2026 |                                                                                                                                          |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2027 | <b>Assuming Gamma Distribution</b>                                                                                                       |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2028 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               | 251.8                          |        | 95% Adjusted Gamma UCL (use when n<50)              | 252.8 |   |   |                                     |       |   |   |   |
| 2029 |                                                                                                                                          |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2030 | <b>Lognormal GOF Test</b>                                                                                                                |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2031 |                                                                                                                                          | Shapiro Wilk Test Statistic    | 0.971  | <b>Shapiro Wilk Lognormal GOF Test</b>              |       |   |   |                                     |       |   |   |   |
| 2032 |                                                                                                                                          | 5% Shapiro Wilk P Value        | 0.306  | Data appear Lognormal at 5% Significance Level      |       |   |   |                                     |       |   |   |   |
| 2033 |                                                                                                                                          | Lilliefors Test Statistic      | 0.077  | <b>Lilliefors Lognormal GOF Test</b>                |       |   |   |                                     |       |   |   |   |
| 2034 |                                                                                                                                          | 5% Lilliefors Critical Value   | 0.11   | Data appear Lognormal at 5% Significance Level      |       |   |   |                                     |       |   |   |   |
| 2035 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2036 |                                                                                                                                          |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2037 | <b>Lognormal Statistics</b>                                                                                                              |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2038 |                                                                                                                                          | Minimum of Logged Data         | 2.944  |                                                     |       |   |   | Mean of logged Data                 | 5.007 |   |   |   |
| 2039 |                                                                                                                                          | Maximum of Logged Data         | 6.918  |                                                     |       |   |   | SD of logged Data                   | 0.816 |   |   |   |
| 2040 |                                                                                                                                          |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2041 | <b>Assuming Lognormal Distribution</b>                                                                                                   |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2042 |                                                                                                                                          | 95% H-UCL                      | 258.5  |                                                     |       |   |   | 90% Chebyshev (MVUE) UCL            | 278.2 |   |   |   |
| 2043 |                                                                                                                                          | 95% Chebyshev (MVUE) UCL       | 310.4  |                                                     |       |   |   | 97.5% Chebyshev (MVUE) UCL          | 355.1 |   |   |   |
| 2044 |                                                                                                                                          | 99% Chebyshev (MVUE) UCL       | 443    |                                                     |       |   |   |                                     |       |   |   |   |
| 2045 |                                                                                                                                          |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2046 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2047 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2048 |                                                                                                                                          |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2049 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2050 |                                                                                                                                          | 95% CLT UCL                    | 253.6  |                                                     |       |   |   | 95% Jackknife UCL                   | 254.2 |   |   |   |
| 2051 |                                                                                                                                          | 95% Standard Bootstrap UCL     | 252.3  |                                                     |       |   |   | 95% Bootstrap-t UCL                 | 263.4 |   |   |   |
| 2052 |                                                                                                                                          | 95% Hall's Bootstrap UCL       | 263.4  |                                                     |       |   |   | 95% Percentile Bootstrap UCL        | 255.7 |   |   |   |
| 2053 |                                                                                                                                          | 95% BCA Bootstrap UCL          | 258.7  |                                                     |       |   |   |                                     |       |   |   |   |
| 2054 |                                                                                                                                          | 90% Chebyshev(Mean, Sd) UCL    | 288.1  |                                                     |       |   |   | 95% Chebyshev(Mean, Sd) UCL         | 322.8 |   |   |   |
| 2055 |                                                                                                                                          | 97.5% Chebyshev(Mean, Sd) UCL  | 370.9  |                                                     |       |   |   | 99% Chebyshev(Mean, Sd) UCL         | 465.4 |   |   |   |
| 2056 |                                                                                                                                          |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2057 | <b>Suggested UCL to Use</b>                                                                                                              |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2058 |                                                                                                                                          | 95% H-UCL                      | 258.5  |                                                     |       |   |   |                                     |       |   |   |   |
| 2059 |                                                                                                                                          |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2060 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2061 | Recommendations are based upon data size, data distribution, and skewness.                                                               |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2062 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2063 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2064 |                                                                                                                                          |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2065 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2066 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2067 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2068 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2069 |                                                                                                                                          |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2070 |                                                                                                                                          |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2071 | <b>Result (eu8_iron)</b>                                                                                                                 |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2072 |                                                                                                                                          |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2073 | <b>General Statistics</b>                                                                                                                |                                |        |                                                     |       |   |   |                                     |       |   |   |   |
| 2074 |                                                                                                                                          | Total Number of Observations   | 65     |                                                     |       |   |   | Number of Distinct Observations     | 61    |   |   |   |
| 2075 |                                                                                                                                          |                                |        |                                                     |       |   |   | Number of Missing Observations      | 0     |   |   |   |
| 2076 |                                                                                                                                          | Minimum                        | 17700  |                                                     |       |   |   | Mean                                | 55255 |   |   |   |
| 2077 |                                                                                                                                          | Maximum                        | 180000 |                                                     |       |   |   | Median                              | 47300 |   |   |   |

|      | A                                                                                                                            | B | C | D | E | F                                           | G         | H | I | J | K                                                   | L     |  |
|------|------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---------------------------------------------|-----------|---|---|---|-----------------------------------------------------|-------|--|
| 2078 |                                                                                                                              |   |   |   |   | SD                                          | 27840     |   |   |   | Std. Error of Mean                                  | 3453  |  |
| 2079 |                                                                                                                              |   |   |   |   | Coefficient of Variation                    | 0.504     |   |   |   | Skewness                                            | 2.187 |  |
| 2080 |                                                                                                                              |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2081 | <b>Normal GOF Test</b>                                                                                                       |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2082 |                                                                                                                              |   |   |   |   | Shapiro Wilk Test Statistic                 | 0.808     |   |   |   | <b>Shapiro Wilk GOF Test</b>                        |       |  |
| 2083 |                                                                                                                              |   |   |   |   | 5% Shapiro Wilk P Value                     | 2.373E-11 |   |   |   | Data Not Normal at 5% Significance Level            |       |  |
| 2084 |                                                                                                                              |   |   |   |   | Lilliefors Test Statistic                   | 0.187     |   |   |   | <b>Lilliefors GOF Test</b>                          |       |  |
| 2085 |                                                                                                                              |   |   |   |   | 5% Lilliefors Critical Value                | 0.11      |   |   |   | Data Not Normal at 5% Significance Level            |       |  |
| 2086 | <b>Data Not Normal at 5% Significance Level</b>                                                                              |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2087 |                                                                                                                              |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2088 | <b>Assuming Normal Distribution</b>                                                                                          |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2089 |                                                                                                                              |   |   |   |   | <b>95% Normal UCL</b>                       |           |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b>             |       |  |
| 2090 |                                                                                                                              |   |   |   |   | 95% Student's-t UCL                         | 61019     |   |   |   | 95% Adjusted-CLT UCL (Chen-1995)                    | 61936 |  |
| 2091 |                                                                                                                              |   |   |   |   |                                             |           |   |   |   | 95% Modified-t UCL (Johnson-1978)                   | 61175 |  |
| 2092 |                                                                                                                              |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2093 | <b>Gamma GOF Test</b>                                                                                                        |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2094 |                                                                                                                              |   |   |   |   | A-D Test Statistic                          | 1.513     |   |   |   | <b>Anderson-Darling Gamma GOF Test</b>              |       |  |
| 2095 |                                                                                                                              |   |   |   |   | 5% A-D Critical Value                       | 0.754     |   |   |   | Data Not Gamma Distributed at 5% Significance Level |       |  |
| 2096 |                                                                                                                              |   |   |   |   | K-S Test Statistic                          | 0.13      |   |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |       |  |
| 2097 |                                                                                                                              |   |   |   |   | 5% K-S Critical Value                       | 0.111     |   |   |   | Data Not Gamma Distributed at 5% Significance Level |       |  |
| 2098 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2099 |                                                                                                                              |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2100 | <b>Gamma Statistics</b>                                                                                                      |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2101 |                                                                                                                              |   |   |   |   | k hat (MLE)                                 | 5.446     |   |   |   | k star (bias corrected MLE)                         | 5.205 |  |
| 2102 |                                                                                                                              |   |   |   |   | Theta hat (MLE)                             | 10146     |   |   |   | Theta star (bias corrected MLE)                     | 10616 |  |
| 2103 |                                                                                                                              |   |   |   |   | nu hat (MLE)                                | 708       |   |   |   | nu star (bias corrected)                            | 676.6 |  |
| 2104 |                                                                                                                              |   |   |   |   | MLE Mean (bias corrected)                   | 55255     |   |   |   | MLE Sd (bias corrected)                             | 24220 |  |
| 2105 |                                                                                                                              |   |   |   |   |                                             |           |   |   |   | Approximate Chi Square Value (0.05)                 | 617.3 |  |
| 2106 |                                                                                                                              |   |   |   |   | Adjusted Level of Significance              | 0.0463    |   |   |   | Adjusted Chi Square Value                           | 616   |  |
| 2107 |                                                                                                                              |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2108 | <b>Assuming Gamma Distribution</b>                                                                                           |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2109 |                                                                                                                              |   |   |   |   | 95% Approximate Gamma UCL (use when n>=50)) | 60568     |   |   |   | 95% Adjusted Gamma UCL (use when n<50)              | 60694 |  |
| 2110 |                                                                                                                              |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2111 | <b>Lognormal GOF Test</b>                                                                                                    |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2112 |                                                                                                                              |   |   |   |   | Shapiro Wilk Test Statistic                 | 0.964     |   |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>              |       |  |
| 2113 |                                                                                                                              |   |   |   |   | 5% Shapiro Wilk P Value                     | 0.142     |   |   |   | Data appear Lognormal at 5% Significance Level      |       |  |
| 2114 |                                                                                                                              |   |   |   |   | Lilliefors Test Statistic                   | 0.0994    |   |   |   | <b>Lilliefors Lognormal GOF Test</b>                |       |  |
| 2115 |                                                                                                                              |   |   |   |   | 5% Lilliefors Critical Value                | 0.11      |   |   |   | Data appear Lognormal at 5% Significance Level      |       |  |
| 2116 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                        |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2117 |                                                                                                                              |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2118 | <b>Lognormal Statistics</b>                                                                                                  |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2119 |                                                                                                                              |   |   |   |   | Minimum of Logged Data                      | 9.781     |   |   |   | Mean of logged Data                                 | 10.83 |  |
| 2120 |                                                                                                                              |   |   |   |   | Maximum of Logged Data                      | 12.1      |   |   |   | SD of logged Data                                   | 0.419 |  |
| 2121 |                                                                                                                              |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2122 | <b>Assuming Lognormal Distribution</b>                                                                                       |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2123 |                                                                                                                              |   |   |   |   | 95% H-UCL                                   | 60342     |   |   |   | 90% Chebyshev (MVUE) UCL                            | 63647 |  |
| 2124 |                                                                                                                              |   |   |   |   | 95% Chebyshev (MVUE) UCL                    | 67658     |   |   |   | 97.5% Chebyshev (MVUE) UCL                          | 73226 |  |
| 2125 |                                                                                                                              |   |   |   |   | 99% Chebyshev (MVUE) UCL                    | 84161     |   |   |   |                                                     |       |  |
| 2126 |                                                                                                                              |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2127 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                        |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2128 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                             |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2129 |                                                                                                                              |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2130 | <b>Nonparametric Distribution Free UCLs</b>                                                                                  |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2131 |                                                                                                                              |   |   |   |   | 95% CLT UCL                                 | 60935     |   |   |   | 95% Jackknife UCL                                   | 61019 |  |
| 2132 |                                                                                                                              |   |   |   |   | 95% Standard Bootstrap UCL                  | 60809     |   |   |   | 95% Bootstrap-t UCL                                 | 62752 |  |
| 2133 |                                                                                                                              |   |   |   |   | 95% Hall's Bootstrap UCL                    | 62771     |   |   |   | 95% Percentile Bootstrap UCL                        | 61000 |  |
| 2134 |                                                                                                                              |   |   |   |   | 95% BCA Bootstrap UCL                       | 61352     |   |   |   |                                                     |       |  |
| 2135 |                                                                                                                              |   |   |   |   | 90% Chebyshev(Mean, Sd) UCL                 | 65615     |   |   |   | 95% Chebyshev(Mean, Sd) UCL                         | 70307 |  |
| 2136 |                                                                                                                              |   |   |   |   | 97.5% Chebyshev(Mean, Sd) UCL               | 76820     |   |   |   | 99% Chebyshev(Mean, Sd) UCL                         | 89614 |  |
| 2137 |                                                                                                                              |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2138 | <b>Suggested UCL to Use</b>                                                                                                  |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2139 |                                                                                                                              |   |   |   |   | 95% Student's-t UCL                         | 61019     |   |   |   | or 95% Modified-t UCL                               | 61175 |  |
| 2140 |                                                                                                                              |   |   |   |   | or 95% H-UCL                                | 60342     |   |   |   |                                                     |       |  |
| 2141 |                                                                                                                              |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2142 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2143 | Recommendations are based upon data size, data distribution, and skewness.                                                   |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |
| 2144 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).     |   |   |   |   |                                             |           |   |   |   |                                                     |       |  |

| A    | B                                                                                                                                        | C      | D | E | F                                       | G | H                                                   | I     | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------|---|---|-----------------------------------------|---|-----------------------------------------------------|-------|---|---|---|
| 2145 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2146 |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2147 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2148 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2149 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2150 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2151 |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2152 |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2153 | <b>Result (eu8_lead)</b>                                                                                                                 |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2154 |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2155 | <b>General Statistics</b>                                                                                                                |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2156 | Total Number of Observations                                                                                                             | 65     |   |   |                                         |   | Number of Distinct Observations                     | 63    |   |   |   |
| 2157 |                                                                                                                                          |        |   |   |                                         |   | Number of Missing Observations                      | 0     |   |   |   |
| 2158 | Minimum                                                                                                                                  | 47.5   |   |   |                                         |   | Mean                                                | 670.9 |   |   |   |
| 2159 | Maximum                                                                                                                                  | 4670   |   |   |                                         |   | Median                                              | 343   |   |   |   |
| 2160 | SD                                                                                                                                       | 932.6  |   |   |                                         |   | Std. Error of Mean                                  | 115.7 |   |   |   |
| 2161 | Coefficient of Variation                                                                                                                 | 1.39   |   |   |                                         |   | Skewness                                            | 3.103 |   |   |   |
| 2162 |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2163 | <b>Normal GOF Test</b>                                                                                                                   |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2164 | Shapiro Wilk Test Statistic                                                                                                              | 0.577  |   |   |                                         |   | <b>Shapiro Wilk GOF Test</b>                        |       |   |   |   |
| 2165 | 5% Shapiro Wilk P Value                                                                                                                  | 0      |   |   |                                         |   | Data Not Normal at 5% Significance Level            |       |   |   |   |
| 2166 | Lilliefors Test Statistic                                                                                                                | 0.282  |   |   |                                         |   | <b>Lilliefors GOF Test</b>                          |       |   |   |   |
| 2167 | 5% Lilliefors Critical Value                                                                                                             | 0.11   |   |   |                                         |   | Data Not Normal at 5% Significance Level            |       |   |   |   |
| 2168 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2169 |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2170 | <b>Assuming Normal Distribution</b>                                                                                                      |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2171 | <b>95% Normal UCL</b>                                                                                                                    |        |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |                                                     |       |   |   |   |
| 2172 | 95% Student's-t UCL                                                                                                                      | 864    |   |   |                                         |   | 95% Adjusted-CLT UCL (Chen-1995)                    | 908.8 |   |   |   |
| 2173 |                                                                                                                                          |        |   |   |                                         |   | 95% Modified-t UCL (Johnson-1978)                   | 871.4 |   |   |   |
| 2174 |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2175 | <b>Gamma GOF Test</b>                                                                                                                    |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2176 | A-D Test Statistic                                                                                                                       | 2.97   |   |   |                                         |   | <b>Anderson-Darling Gamma GOF Test</b>              |       |   |   |   |
| 2177 | 5% A-D Critical Value                                                                                                                    | 0.778  |   |   |                                         |   | Data Not Gamma Distributed at 5% Significance Level |       |   |   |   |
| 2178 | K-S Test Statistic                                                                                                                       | 0.164  |   |   |                                         |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |       |   |   |   |
| 2179 | 5% K-S Critical Value                                                                                                                    | 0.114  |   |   |                                         |   | Data Not Gamma Distributed at 5% Significance Level |       |   |   |   |
| 2180 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2181 |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2182 | <b>Gamma Statistics</b>                                                                                                                  |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2183 | k hat (MLE)                                                                                                                              | 1.105  |   |   |                                         |   | k star (bias corrected MLE)                         | 1.064 |   |   |   |
| 2184 | Theta hat (MLE)                                                                                                                          | 607.2  |   |   |                                         |   | Theta star (bias corrected MLE)                     | 630.4 |   |   |   |
| 2185 | nu hat (MLE)                                                                                                                             | 143.7  |   |   |                                         |   | nu star (bias corrected)                            | 138.4 |   |   |   |
| 2186 | MLE Mean (bias corrected)                                                                                                                | 670.9  |   |   |                                         |   | MLE Sd (bias corrected)                             | 650.3 |   |   |   |
| 2187 |                                                                                                                                          |        |   |   |                                         |   | Approximate Chi Square Value (0.05)                 | 112.2 |   |   |   |
| 2188 | Adjusted Level of Significance                                                                                                           | 0.0463 |   |   |                                         |   | Adjusted Chi Square Value                           | 111.6 |   |   |   |
| 2189 |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2190 | <b>Assuming Gamma Distribution</b>                                                                                                       |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2191 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | 827.5  |   |   |                                         |   | 95% Adjusted Gamma UCL (use when n<50)              | 831.4 |   |   |   |
| 2192 |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2193 | <b>Lognormal GOF Test</b>                                                                                                                |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2194 | Shapiro Wilk Test Statistic                                                                                                              | 0.961  |   |   |                                         |   | <b>Shapiro Wilk Lognormal GOF Test</b>              |       |   |   |   |
| 2195 | 5% Shapiro Wilk P Value                                                                                                                  | 0.0938 |   |   |                                         |   | Data appear Lognormal at 5% Significance Level      |       |   |   |   |
| 2196 | Lilliefors Test Statistic                                                                                                                | 0.1    |   |   |                                         |   | <b>Lilliefors Lognormal GOF Test</b>                |       |   |   |   |
| 2197 | 5% Lilliefors Critical Value                                                                                                             | 0.11   |   |   |                                         |   | Data appear Lognormal at 5% Significance Level      |       |   |   |   |
| 2198 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2199 |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2200 | <b>Lognormal Statistics</b>                                                                                                              |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2201 | Minimum of Logged Data                                                                                                                   | 3.861  |   |   |                                         |   | Mean of logged Data                                 | 5.992 |   |   |   |
| 2202 | Maximum of Logged Data                                                                                                                   | 8.449  |   |   |                                         |   | SD of logged Data                                   | 0.941 |   |   |   |
| 2203 |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2204 | <b>Assuming Lognormal Distribution</b>                                                                                                   |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2205 | 95% H-UCL                                                                                                                                | 808.9  |   |   |                                         |   | 90% Chebyshev (MVUE) UCL                            | 869.7 |   |   |   |
| 2206 | 95% Chebyshev (MVUE) UCL                                                                                                                 | 984.1  |   |   |                                         |   | 97.5% Chebyshev (MVUE) UCL                          | 1143  |   |   |   |
| 2207 | 99% Chebyshev (MVUE) UCL                                                                                                                 | 1455   |   |   |                                         |   |                                                     |       |   |   |   |
| 2208 |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2209 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2210 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |        |   |   |                                         |   |                                                     |       |   |   |   |
| 2211 |                                                                                                                                          |        |   |   |                                         |   |                                                     |       |   |   |   |

| A    | B                                                                                                                                        | C | D | E         | F                                                               | G | H | I     | J | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|-----------|-----------------------------------------------------------------|---|---|-------|---|---|---|--|
| 2212 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2213 | 95% CLT UCL                                                                                                                              |   |   | 861.2     | 95% Jackknife UCL                                               |   |   | 864   |   |   |   |  |
| 2214 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 856.6     | 95% Bootstrap-t UCL                                             |   |   | 935.8 |   |   |   |  |
| 2215 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 915.8     | 95% Percentile Bootstrap UCL                                    |   |   | 854.7 |   |   |   |  |
| 2216 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 919.1     |                                                                 |   |   |       |   |   |   |  |
| 2217 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 1018      | 95% Chebyshev(Mean, Sd) UCL                                     |   |   | 1175  |   |   |   |  |
| 2218 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 1393      | 99% Chebyshev(Mean, Sd) UCL                                     |   |   | 1822  |   |   |   |  |
| 2219 |                                                                                                                                          |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2220 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2221 | 95% H-UCL                                                                                                                                |   |   | 808.9     |                                                                 |   |   |       |   |   |   |  |
| 2222 |                                                                                                                                          |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2223 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2224 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2225 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2226 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2227 |                                                                                                                                          |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2228 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                   |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2229 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>            |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2230 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                       |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2231 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>        |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2232 |                                                                                                                                          |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2233 |                                                                                                                                          |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2234 | <b>Result (eu8_manganese)</b>                                                                                                            |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2235 |                                                                                                                                          |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2236 | <b>General Statistics</b>                                                                                                                |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2237 | Total Number of Observations                                                                                                             |   |   | 65        | Number of Distinct Observations                                 |   |   | 62    |   |   |   |  |
| 2238 |                                                                                                                                          |   |   |           | Number of Missing Observations                                  |   |   | 0     |   |   |   |  |
| 2239 | Minimum                                                                                                                                  |   |   | 433       | Mean                                                            |   |   | 1711  |   |   |   |  |
| 2240 | Maximum                                                                                                                                  |   |   | 6610      | Median                                                          |   |   | 1560  |   |   |   |  |
| 2241 | SD                                                                                                                                       |   |   | 1036      | Std. Error of Mean                                              |   |   | 128.5 |   |   |   |  |
| 2242 | Coefficient of Variation                                                                                                                 |   |   | 0.606     | Skewness                                                        |   |   | 1.943 |   |   |   |  |
| 2243 |                                                                                                                                          |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2244 | <b>Normal GOF Test</b>                                                                                                                   |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2245 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.859     | <b>Shapiro Wilk GOF Test</b>                                    |   |   |       |   |   |   |  |
| 2246 | 5% Shapiro Wilk P Value                                                                                                                  |   |   | 3.5864E-8 | Data Not Normal at 5% Significance Level                        |   |   |       |   |   |   |  |
| 2247 | Lilliefors Test Statistic                                                                                                                |   |   | 0.117     | <b>Lilliefors GOF Test</b>                                      |   |   |       |   |   |   |  |
| 2248 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.11      | Data Not Normal at 5% Significance Level                        |   |   |       |   |   |   |  |
| 2249 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2250 |                                                                                                                                          |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2251 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2252 | <b>95% Normal UCL</b>                                                                                                                    |   |   |           | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |       |   |   |   |  |
| 2253 | 95% Student's-t UCL                                                                                                                      |   |   | 1926      | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   | 1956  |   |   |   |  |
| 2254 |                                                                                                                                          |   |   |           | 95% Modified-t UCL (Johnson-1978)                               |   |   | 1931  |   |   |   |  |
| 2255 |                                                                                                                                          |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2256 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2257 | A-D Test Statistic                                                                                                                       |   |   | 0.442     | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |       |   |   |   |  |
| 2258 | 5% A-D Critical Value                                                                                                                    |   |   | 0.757     | Detected data appear Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |  |
| 2259 | K-S Test Statistic                                                                                                                       |   |   | 0.0791    | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |       |   |   |   |  |
| 2260 | 5% K-S Critical Value                                                                                                                    |   |   | 0.111     | Detected data appear Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |  |
| 2261 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2262 |                                                                                                                                          |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2263 | <b>Gamma Statistics</b>                                                                                                                  |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2264 | k hat (MLE)                                                                                                                              |   |   | 3.36      | k star (bias corrected MLE)                                     |   |   | 3.215 |   |   |   |  |
| 2265 | Theta hat (MLE)                                                                                                                          |   |   | 509.3     | Theta star (bias corrected MLE)                                 |   |   | 532.3 |   |   |   |  |
| 2266 | nu hat (MLE)                                                                                                                             |   |   | 436.8     | nu star (bias corrected)                                        |   |   | 418   |   |   |   |  |
| 2267 | MLE Mean (bias corrected)                                                                                                                |   |   | 1711      | MLE Sd (bias corrected)                                         |   |   | 954.4 |   |   |   |  |
| 2268 |                                                                                                                                          |   |   |           | Approximate Chi Square Value (0.05)                             |   |   | 371.6 |   |   |   |  |
| 2269 | Adjusted Level of Significance                                                                                                           |   |   | 0.0463    | Adjusted Chi Square Value                                       |   |   | 370.6 |   |   |   |  |
| 2270 |                                                                                                                                          |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2271 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2272 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   |   | 1925      | 95% Adjusted Gamma UCL (use when n<50)                          |   |   | 1930  |   |   |   |  |
| 2273 |                                                                                                                                          |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2274 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |           |                                                                 |   |   |       |   |   |   |  |
| 2275 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.98      | <b>Shapiro Wilk Lognormal GOF Test</b>                          |   |   |       |   |   |   |  |
| 2276 | 5% Shapiro Wilk P Value                                                                                                                  |   |   | 0.64      | Data appear Lognormal at 5% Significance Level                  |   |   |       |   |   |   |  |
| 2277 | Lilliefors Test Statistic                                                                                                                |   |   | 0.0774    | <b>Lilliefors Lognormal GOF Test</b>                            |   |   |       |   |   |   |  |
| 2278 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.11      | Data appear Lognormal at 5% Significance Level                  |   |   |       |   |   |   |  |

| A    | B                                                                                                                                        | C     | D                                                               | E                                 | F      | G | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------|-----------------------------------|--------|---|---|---|---|---|---|
| 2279 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2280 |                                                                                                                                          |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2281 | <b>Lognormal Statistics</b>                                                                                                              |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2282 | Minimum of Logged Data                                                                                                                   | 6.071 |                                                                 | Mean of logged Data               | 7.289  |   |   |   |   |   |   |
| 2283 | Maximum of Logged Data                                                                                                                   | 8.796 |                                                                 | SD of logged Data                 | 0.562  |   |   |   |   |   |   |
| 2284 |                                                                                                                                          |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2285 | <b>Assuming Lognormal Distribution</b>                                                                                                   |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2286 | 95% H-UCL                                                                                                                                | 1960  |                                                                 | 90% Chebyshev (MVUE) UCL          | 2090   |   |   |   |   |   |   |
| 2287 | 95% Chebyshev (MVUE) UCL                                                                                                                 | 2263  |                                                                 | 97.5% Chebyshev (MVUE) UCL        | 2502   |   |   |   |   |   |   |
| 2288 | 99% Chebyshev (MVUE) UCL                                                                                                                 | 2973  |                                                                 |                                   |        |   |   |   |   |   |   |
| 2289 |                                                                                                                                          |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2290 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2291 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2292 |                                                                                                                                          |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2293 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2294 | 95% CLT UCL                                                                                                                              | 1923  |                                                                 | 95% Jackknife UCL                 | 1926   |   |   |   |   |   |   |
| 2295 | 95% Standard Bootstrap UCL                                                                                                               | 1920  |                                                                 | 95% Bootstrap-t UCL               | 1968   |   |   |   |   |   |   |
| 2296 | 95% Hall's Bootstrap UCL                                                                                                                 | 1992  |                                                                 | 95% Percentile Bootstrap UCL      | 1924   |   |   |   |   |   |   |
| 2297 | 95% BCA Bootstrap UCL                                                                                                                    | 1949  |                                                                 |                                   |        |   |   |   |   |   |   |
| 2298 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              | 2097  |                                                                 | 95% Chebyshev(Mean, Sd) UCL       | 2272   |   |   |   |   |   |   |
| 2299 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            | 2514  |                                                                 | 99% Chebyshev(Mean, Sd) UCL       | 2990   |   |   |   |   |   |   |
| 2300 |                                                                                                                                          |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2301 | <b>Suggested UCL to Use</b>                                                                                                              |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2302 | 95% Approximate Gamma UCL                                                                                                                | 1925  |                                                                 |                                   |        |   |   |   |   |   |   |
| 2303 |                                                                                                                                          |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2304 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2305 | Recommendations are based upon data size, data distribution, and skewness.                                                               |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2306 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2307 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2308 |                                                                                                                                          |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2309 | <b>Result (eu8_thallium)</b>                                                                                                             |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2310 |                                                                                                                                          |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2311 | <b>General Statistics</b>                                                                                                                |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2312 | Total Number of Observations                                                                                                             | 65    |                                                                 | Number of Distinct Observations   | 39     |   |   |   |   |   |   |
| 2313 | Number of Detects                                                                                                                        | 14    |                                                                 | Number of Non-Detects             | 51     |   |   |   |   |   |   |
| 2314 | Number of Distinct Detects                                                                                                               | 12    |                                                                 | Number of Distinct Non-Detects    | 27     |   |   |   |   |   |   |
| 2315 | Minimum Detect                                                                                                                           | 0.045 |                                                                 | Minimum Non-Detect                | 0.036  |   |   |   |   |   |   |
| 2316 | Maximum Detect                                                                                                                           | 1.26  |                                                                 | Maximum Non-Detect                | 2.51   |   |   |   |   |   |   |
| 2317 | Variance Detects                                                                                                                         | 0.137 |                                                                 | Percent Non-Detects               | 78.46% |   |   |   |   |   |   |
| 2318 | Mean Detects                                                                                                                             | 0.338 |                                                                 | SD Detects                        | 0.37   |   |   |   |   |   |   |
| 2319 | Median Detects                                                                                                                           | 0.18  |                                                                 | CV Detects                        | 1.095  |   |   |   |   |   |   |
| 2320 | Skewness Detects                                                                                                                         | 1.606 |                                                                 | Kurtosis Detects                  | 1.811  |   |   |   |   |   |   |
| 2321 | Mean of Logged Detects                                                                                                                   | -1.6  |                                                                 | SD of Logged Detects              | 1.058  |   |   |   |   |   |   |
| 2322 |                                                                                                                                          |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2323 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2324 | Shapiro Wilk Test Statistic                                                                                                              | 0.765 |                                                                 | <b>Shapiro Wilk GOF Test</b>      |        |   |   |   |   |   |   |
| 2325 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.874 | Detected Data Not Normal at 5% Significance Level               |                                   |        |   |   |   |   |   |   |
| 2326 | Lilliefors Test Statistic                                                                                                                | 0.288 |                                                                 | <b>Lilliefors GOF Test</b>        |        |   |   |   |   |   |   |
| 2327 | 5% Lilliefors Critical Value                                                                                                             | 0.226 | Detected Data Not Normal at 5% Significance Level               |                                   |        |   |   |   |   |   |   |
| 2328 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2329 |                                                                                                                                          |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2330 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2331 | KM Mean                                                                                                                                  | 0.121 |                                                                 | KM Standard Error of Mean         | 0.0315 |   |   |   |   |   |   |
| 2332 | KM SD                                                                                                                                    | 0.222 |                                                                 | 95% KM (BCA) UCL                  | 0.185  |   |   |   |   |   |   |
| 2333 | 95% KM (t) UCL                                                                                                                           | 0.173 |                                                                 | 95% KM (Percentile Bootstrap) UCL | 0.177  |   |   |   |   |   |   |
| 2334 | 95% KM (z) UCL                                                                                                                           | 0.173 |                                                                 | 95% KM Bootstrap t UCL            | 0.193  |   |   |   |   |   |   |
| 2335 | 90% KM Chebyshev UCL                                                                                                                     | 0.215 |                                                                 | 95% KM Chebyshev UCL              | 0.258  |   |   |   |   |   |   |
| 2336 | 97.5% KM Chebyshev UCL                                                                                                                   | 0.317 |                                                                 | 99% KM Chebyshev UCL              | 0.434  |   |   |   |   |   |   |
| 2337 |                                                                                                                                          |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2338 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2339 | A-D Test Statistic                                                                                                                       | 0.578 |                                                                 | <b>Anderson-Darling GOF Test</b>  |        |   |   |   |   |   |   |
| 2340 | 5% A-D Critical Value                                                                                                                    | 0.758 | Detected data appear Gamma Distributed at 5% Significance Level |                                   |        |   |   |   |   |   |   |
| 2341 | K-S Test Statistic                                                                                                                       | 0.213 |                                                                 | <b>Kolmogorov-Smirnov GOF</b>     |        |   |   |   |   |   |   |
| 2342 | 5% K-S Critical Value                                                                                                                    | 0.235 | Detected data appear Gamma Distributed at 5% Significance Level |                                   |        |   |   |   |   |   |   |
| 2343 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2344 |                                                                                                                                          |       |                                                                 |                                   |        |   |   |   |   |   |   |
| 2345 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |       |                                                                 |                                   |        |   |   |   |   |   |   |

|      | A                                                                                                                         | B | C | D | E                                                   | F      | G                           | H | I | J                                                       | K | L      |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|---|-----------------------------------------------------|--------|-----------------------------|---|---|---------------------------------------------------------|---|--------|
| 2346 |                                                                                                                           |   |   |   | k hat (MLE)                                         | 1.107  |                             |   |   | k star (bias corrected MLE)                             |   | 0.918  |
| 2347 |                                                                                                                           |   |   |   | Theta hat (MLE)                                     | 0.305  |                             |   |   | Theta star (bias corrected MLE)                         |   | 0.368  |
| 2348 |                                                                                                                           |   |   |   | nu hat (MLE)                                        | 31     |                             |   |   | nu star (bias corrected)                                |   | 25.69  |
| 2349 |                                                                                                                           |   |   |   | Mean (detects)                                      | 0.338  |                             |   |   |                                                         |   |        |
| 2350 |                                                                                                                           |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2351 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2352 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2353 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2354 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2355 | This is especially true when the sample size is small.                                                                    |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2356 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2357 |                                                                                                                           |   |   |   | Minimum                                             | 0.01   |                             |   |   | Mean                                                    |   | 0.0815 |
| 2358 |                                                                                                                           |   |   |   | Maximum                                             | 1.26   |                             |   |   | Median                                                  |   | 0.01   |
| 2359 |                                                                                                                           |   |   |   | SD                                                  | 0.215  |                             |   |   | CV                                                      |   | 2.639  |
| 2360 |                                                                                                                           |   |   |   | k hat (MLE)                                         | 0.456  |                             |   |   | k star (bias corrected MLE)                             |   | 0.446  |
| 2361 |                                                                                                                           |   |   |   | Theta hat (MLE)                                     | 0.179  |                             |   |   | Theta star (bias corrected MLE)                         |   | 0.183  |
| 2362 |                                                                                                                           |   |   |   | nu hat (MLE)                                        | 59.33  |                             |   |   | nu star (bias corrected)                                |   | 57.93  |
| 2363 |                                                                                                                           |   |   |   | Adjusted Level of Significance ( $\beta$ )          | 0.0463 |                             |   |   |                                                         |   |        |
| 2364 |                                                                                                                           |   |   |   | Approximate Chi Square Value (57.93, $\alpha$ )     | 41.43  |                             |   |   | Adjusted Chi Square Value (57.93, $\beta$ )             |   | 41.12  |
| 2365 |                                                                                                                           |   |   |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )   | 0.114  |                             |   |   | 95% Gamma Adjusted UCL (use when $n < 50$ )             |   | 0.115  |
| 2366 |                                                                                                                           |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2367 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2368 |                                                                                                                           |   |   |   | Mean (KM)                                           | 0.121  |                             |   |   | SD (KM)                                                 |   | 0.222  |
| 2369 |                                                                                                                           |   |   |   | Variance (KM)                                       | 0.0493 |                             |   |   | SE of Mean (KM)                                         |   | 0.0315 |
| 2370 |                                                                                                                           |   |   |   | k hat (KM)                                          | 0.296  |                             |   |   | k star (KM)                                             |   | 0.293  |
| 2371 |                                                                                                                           |   |   |   | nu hat (KM)                                         | 38.51  |                             |   |   | nu star (KM)                                            |   | 38.07  |
| 2372 |                                                                                                                           |   |   |   | theta hat (KM)                                      | 0.408  |                             |   |   | theta star (KM)                                         |   | 0.413  |
| 2373 |                                                                                                                           |   |   |   | 80% gamma percentile (KM)                           | 0.184  |                             |   |   | 90% gamma percentile (KM)                               |   | 0.357  |
| 2374 |                                                                                                                           |   |   |   | 95% gamma percentile (KM)                           | 0.557  |                             |   |   | 99% gamma percentile (KM)                               |   | 1.078  |
| 2375 |                                                                                                                           |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2376 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2377 |                                                                                                                           |   |   |   | Approximate Chi Square Value (38.07, $\alpha$ )     | 24.94  |                             |   |   | Adjusted Chi Square Value (38.07, $\beta$ )             |   | 24.7   |
| 2378 |                                                                                                                           |   |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ ) | 0.184  |                             |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )          |   | 0.186  |
| 2379 |                                                                                                                           |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2380 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2381 |                                                                                                                           |   |   |   | Shapiro Wilk Test Statistic                         | 0.942  |                             |   |   | <b>Shapiro Wilk GOF Test</b>                            |   |        |
| 2382 |                                                                                                                           |   |   |   | 5% Shapiro Wilk Critical Value                      | 0.874  |                             |   |   | Detected Data appear Lognormal at 5% Significance Level |   |        |
| 2383 |                                                                                                                           |   |   |   | Lilliefors Test Statistic                           | 0.146  |                             |   |   | <b>Lilliefors GOF Test</b>                              |   |        |
| 2384 |                                                                                                                           |   |   |   | 5% Lilliefors Critical Value                        | 0.226  |                             |   |   | Detected Data appear Lognormal at 5% Significance Level |   |        |
| 2385 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                            |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2386 |                                                                                                                           |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2387 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2388 |                                                                                                                           |   |   |   | Mean in Original Scale                              | 0.088  |                             |   |   | Mean in Log Scale                                       |   | -3.678 |
| 2389 |                                                                                                                           |   |   |   | SD in Original Scale                                | 0.213  |                             |   |   | SD in Log Scale                                         |   | 1.397  |
| 2390 |                                                                                                                           |   |   |   | 95% t UCL (assumes normality of ROS data)           | 0.132  |                             |   |   | 95% Percentile Bootstrap UCL                            |   | 0.135  |
| 2391 |                                                                                                                           |   |   |   | 95% BCA Bootstrap UCL                               | 0.147  |                             |   |   | 95% Bootstrap t UCL                                     |   | 0.167  |
| 2392 |                                                                                                                           |   |   |   | 95% H-UCL (Log ROS)                                 | 0.1    |                             |   |   |                                                         |   |        |
| 2393 |                                                                                                                           |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2394 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2395 |                                                                                                                           |   |   |   | KM Mean (logged)                                    | -2.797 |                             |   |   | KM Geo Mean                                             |   | 0.061  |
| 2396 |                                                                                                                           |   |   |   | KM SD (logged)                                      | 0.938  |                             |   |   | 95% Critical H Value (KM-Log)                           |   | 2.215  |
| 2397 |                                                                                                                           |   |   |   | KM Standard Error of Mean (logged)                  | 0.142  |                             |   |   | 95% H-UCL (KM -Log)                                     |   | 0.123  |
| 2398 |                                                                                                                           |   |   |   | KM SD (logged)                                      | 0.938  |                             |   |   | 95% Critical H Value (KM-Log)                           |   | 2.215  |
| 2399 |                                                                                                                           |   |   |   | KM Standard Error of Mean (logged)                  | 0.142  |                             |   |   |                                                         |   |        |
| 2400 |                                                                                                                           |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2401 | <b>DL/2 Statistics</b>                                                                                                    |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2402 | <b>DL/2 Normal</b>                                                                                                        |   |   |   |                                                     |        | <b>DL/2 Log-Transformed</b> |   |   |                                                         |   |        |
| 2403 |                                                                                                                           |   |   |   | Mean in Original Scale                              | 0.292  |                             |   |   | Mean in Log Scale                                       |   | -2.248 |
| 2404 |                                                                                                                           |   |   |   | SD in Original Scale                                | 0.404  |                             |   |   | SD in Log Scale                                         |   | 1.51   |
| 2405 |                                                                                                                           |   |   |   | 95% t UCL (Assumes normality)                       | 0.376  |                             |   |   | 95% H-Stat UCL                                          |   | 0.524  |
| 2406 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                  |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2407 |                                                                                                                           |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2408 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                     |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2409 | <b>Detected Data appear Gamma Distributed at 5% Significance Level</b>                                                    |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2410 |                                                                                                                           |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2411 | <b>Suggested UCL to Use</b>                                                                                               |   |   |   |                                                     |        |                             |   |   |                                                         |   |        |
| 2412 |                                                                                                                           |   |   |   | 95% KM Approximate Gamma UCL                        | 0.184  |                             |   |   |                                                         |   |        |

| A    | B                                                                                                                                      | C         | D | E | F | G | H | I                                                   | J     | K | L |  |
|------|----------------------------------------------------------------------------------------------------------------------------------------|-----------|---|---|---|---|---|-----------------------------------------------------|-------|---|---|--|
| 2413 |                                                                                                                                        |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2414 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.           |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2415 | Recommendations are based upon data size, data distribution, and skewness.                                                             |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2416 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).               |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2417 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistica |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2418 |                                                                                                                                        |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2419 |                                                                                                                                        |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2420 | <b>Result (eu8_zinc)</b>                                                                                                               |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2421 |                                                                                                                                        |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2422 | <b>General Statistics</b>                                                                                                              |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2423 | Total Number of Observations                                                                                                           | 65        |   |   |   |   |   | Number of Distinct Observations                     | 64    |   |   |  |
| 2424 |                                                                                                                                        |           |   |   |   |   |   | Number of Missing Observations                      | 0     |   |   |  |
| 2425 | Minimum                                                                                                                                | 183       |   |   |   |   |   | Mean                                                | 1099  |   |   |  |
| 2426 | Maximum                                                                                                                                | 5330      |   |   |   |   |   | Median                                              | 776   |   |   |  |
| 2427 | SD                                                                                                                                     | 962.6     |   |   |   |   |   | Std. Error of Mean                                  | 119.4 |   |   |  |
| 2428 | Coefficient of Variation                                                                                                               | 0.876     |   |   |   |   |   | Skewness                                            | 1.901 |   |   |  |
| 2429 |                                                                                                                                        |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2430 | <b>Normal GOF Test</b>                                                                                                                 |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2431 | Shapiro Wilk Test Statistic                                                                                                            | 0.802     |   |   |   |   |   | <b>Shapiro Wilk GOF Test</b>                        |       |   |   |  |
| 2432 | 5% Shapiro Wilk P Value                                                                                                                | 1.143E-11 |   |   |   |   |   | Data Not Normal at 5% Significance Level            |       |   |   |  |
| 2433 | Lilliefors Test Statistic                                                                                                              | 0.201     |   |   |   |   |   | <b>Lilliefors GOF Test</b>                          |       |   |   |  |
| 2434 | 5% Lilliefors Critical Value                                                                                                           | 0.11      |   |   |   |   |   | Data Not Normal at 5% Significance Level            |       |   |   |  |
| 2435 | <b>Data Not Normal at 5% Significance Level</b>                                                                                        |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2436 |                                                                                                                                        |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2437 | <b>Assuming Normal Distribution</b>                                                                                                    |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2438 | <b>95% Normal UCL</b>                                                                                                                  |           |   |   |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b>             |       |   |   |  |
| 2439 | 95% Student's-t UCL                                                                                                                    | 1298      |   |   |   |   |   | 95% Adjusted-CLT UCL (Chen-1995)                    | 1326  |   |   |  |
| 2440 |                                                                                                                                        |           |   |   |   |   |   | 95% Modified-t UCL (Johnson-1978)                   | 1303  |   |   |  |
| 2441 |                                                                                                                                        |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2442 | <b>Gamma GOF Test</b>                                                                                                                  |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2443 | A-D Test Statistic                                                                                                                     | 1.298     |   |   |   |   |   | <b>Anderson-Darling Gamma GOF Test</b>              |       |   |   |  |
| 2444 | 5% A-D Critical Value                                                                                                                  | 0.766     |   |   |   |   |   | Data Not Gamma Distributed at 5% Significance Level |       |   |   |  |
| 2445 | K-S Test Statistic                                                                                                                     | 0.13      |   |   |   |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |       |   |   |  |
| 2446 | 5% K-S Critical Value                                                                                                                  | 0.112     |   |   |   |   |   | Data Not Gamma Distributed at 5% Significance Level |       |   |   |  |
| 2447 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                             |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2448 |                                                                                                                                        |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2449 | <b>Gamma Statistics</b>                                                                                                                |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2450 | k hat (MLE)                                                                                                                            | 1.72      |   |   |   |   |   | k star (bias corrected MLE)                         | 1.651 |   |   |  |
| 2451 | Theta hat (MLE)                                                                                                                        | 638.9     |   |   |   |   |   | Theta star (bias corrected MLE)                     | 665.7 |   |   |  |
| 2452 | nu hat (MLE)                                                                                                                           | 223.6     |   |   |   |   |   | nu star (bias corrected)                            | 214.6 |   |   |  |
| 2453 | MLE Mean (bias corrected)                                                                                                              | 1099      |   |   |   |   |   | MLE Sd (bias corrected)                             | 855.3 |   |   |  |
| 2454 |                                                                                                                                        |           |   |   |   |   |   | Approximate Chi Square Value (0.05)                 | 181.7 |   |   |  |
| 2455 | Adjusted Level of Significance                                                                                                         | 0.0463    |   |   |   |   |   | Adjusted Chi Square Value                           | 181.1 |   |   |  |
| 2456 |                                                                                                                                        |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2457 | <b>Assuming Gamma Distribution</b>                                                                                                     |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2458 | 95% Approximate Gamma UCL (use when n>=50))                                                                                            | 1298      |   |   |   |   |   | 95% Adjusted Gamma UCL (use when n<50)              | 1303  |   |   |  |
| 2459 |                                                                                                                                        |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2460 | <b>Lognormal GOF Test</b>                                                                                                              |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2461 | Shapiro Wilk Test Statistic                                                                                                            | 0.959     |   |   |   |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>              |       |   |   |  |
| 2462 | 5% Shapiro Wilk P Value                                                                                                                | 0.0742    |   |   |   |   |   | Data appear Lognormal at 5% Significance Level      |       |   |   |  |
| 2463 | Lilliefors Test Statistic                                                                                                              | 0.0878    |   |   |   |   |   | <b>Lilliefors Lognormal GOF Test</b>                |       |   |   |  |
| 2464 | 5% Lilliefors Critical Value                                                                                                           | 0.11      |   |   |   |   |   | Data appear Lognormal at 5% Significance Level      |       |   |   |  |
| 2465 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                  |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2466 |                                                                                                                                        |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2467 | <b>Lognormal Statistics</b>                                                                                                            |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2468 | Minimum of Logged Data                                                                                                                 | 5.209     |   |   |   |   |   | Mean of logged Data                                 | 6.684 |   |   |  |
| 2469 | Maximum of Logged Data                                                                                                                 | 8.581     |   |   |   |   |   | SD of logged Data                                   | 0.794 |   |   |  |
| 2470 |                                                                                                                                        |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2471 | <b>Assuming Lognormal Distribution</b>                                                                                                 |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2472 | 95% H-UCL                                                                                                                              | 1349      |   |   |   |   |   | 90% Chebyshev (MVUE) UCL                            | 1452  |   |   |  |
| 2473 | 95% Chebyshev (MVUE) UCL                                                                                                               | 1616      |   |   |   |   |   | 97.5% Chebyshev (MVUE) UCL                          | 1843  |   |   |  |
| 2474 | 99% Chebyshev (MVUE) UCL                                                                                                               | 2291      |   |   |   |   |   |                                                     |       |   |   |  |
| 2475 |                                                                                                                                        |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2476 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                  |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2477 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                       |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2478 |                                                                                                                                        |           |   |   |   |   |   |                                                     |       |   |   |  |
| 2479 | <b>Nonparametric Distribution Free UCLs</b>                                                                                            |           |   |   |   |   |   |                                                     |       |   |   |  |

| A    | B                                                                                                                                         | C | D                             | E         | F                                                   | G                            | H    | I     | J | K | L |  |
|------|-------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------------------|-----------|-----------------------------------------------------|------------------------------|------|-------|---|---|---|--|
| 2480 |                                                                                                                                           |   | 95% CLT UCL                   | 1295      |                                                     | 95% Jackknife UCL            | 1298 |       |   |   |   |  |
| 2481 |                                                                                                                                           |   | 95% Standard Bootstrap UCL    | 1291      |                                                     | 95% Bootstrap-t UCL          | 1338 |       |   |   |   |  |
| 2482 |                                                                                                                                           |   | 95% Hall's Bootstrap UCL      | 1341      |                                                     | 95% Percentile Bootstrap UCL | 1300 |       |   |   |   |  |
| 2483 |                                                                                                                                           |   | 95% BCA Bootstrap UCL         | 1321      |                                                     |                              |      |       |   |   |   |  |
| 2484 |                                                                                                                                           |   | 90% Chebyshev(Mean, Sd) UCL   | 1457      |                                                     | 95% Chebyshev(Mean, Sd) UCL  | 1620 |       |   |   |   |  |
| 2485 |                                                                                                                                           |   | 97.5% Chebyshev(Mean, Sd) UCL | 1845      |                                                     | 99% Chebyshev(Mean, Sd) UCL  | 2287 |       |   |   |   |  |
| 2486 |                                                                                                                                           |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2487 |                                                                                                                                           |   | <b>Suggested UCL to Use</b>   |           |                                                     |                              |      |       |   |   |   |  |
| 2488 |                                                                                                                                           |   | 95% H-UCL                     | 1349      |                                                     |                              |      |       |   |   |   |  |
| 2489 |                                                                                                                                           |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2490 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2491 | Recommendations are based upon data size, data distribution, and skewness.                                                                |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2492 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2493 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2494 |                                                                                                                                           |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2495 | <b>ProUCL computes and outputs H-statistic based UCLs for historical reasons only.</b>                                                    |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2496 | <b>H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.</b>             |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2497 | <b>It is therefore recommended to avoid the use of H-statistic based 95% UCLs.</b>                                                        |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2498 | <b>Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.</b>         |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2499 |                                                                                                                                           |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2500 |                                                                                                                                           |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2501 | <b>Result (eu9_arsenic)</b>                                                                                                               |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2502 |                                                                                                                                           |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2503 | <b>General Statistics</b>                                                                                                                 |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2504 | Total Number of Observations                                                                                                              |   |                               | 54        | Number of Distinct Observations                     |                              |      | 49    |   |   |   |  |
| 2505 |                                                                                                                                           |   |                               |           | Number of Missing Observations                      |                              |      | 0     |   |   |   |  |
| 2506 | Minimum                                                                                                                                   |   |                               | 3.6       | Mean                                                |                              |      | 27.86 |   |   |   |  |
| 2507 | Maximum                                                                                                                                   |   |                               | 87.8      | Median                                              |                              |      | 23    |   |   |   |  |
| 2508 | SD                                                                                                                                        |   |                               | 16.36     | Std. Error of Mean                                  |                              |      | 2.226 |   |   |   |  |
| 2509 | Coefficient of Variation                                                                                                                  |   |                               | 0.587     | Skewness                                            |                              |      | 1.672 |   |   |   |  |
| 2510 |                                                                                                                                           |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2511 | <b>Normal GOF Test</b>                                                                                                                    |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2512 | Shapiro Wilk Test Statistic                                                                                                               |   |                               | 0.856     | <b>Shapiro Wilk GOF Test</b>                        |                              |      |       |   |   |   |  |
| 2513 | 5% Shapiro Wilk P Value                                                                                                                   |   |                               | 7.6608E-7 | Data Not Normal at 5% Significance Level            |                              |      |       |   |   |   |  |
| 2514 | Lilliefors Test Statistic                                                                                                                 |   |                               | 0.181     | <b>Lilliefors GOF Test</b>                          |                              |      |       |   |   |   |  |
| 2515 | 5% Lilliefors Critical Value                                                                                                              |   |                               | 0.12      | Data Not Normal at 5% Significance Level            |                              |      |       |   |   |   |  |
| 2516 | <b>Data Not Normal at 5% Significance Level</b>                                                                                           |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2517 |                                                                                                                                           |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2518 | <b>Assuming Normal Distribution</b>                                                                                                       |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2519 | <b>95% Normal UCL</b>                                                                                                                     |   |                               |           | <b>95% UCLs (Adjusted for Skewness)</b>             |                              |      |       |   |   |   |  |
| 2520 | 95% Student's-t UCL                                                                                                                       |   |                               | 31.59     | 95% Adjusted-CLT UCL (Chen-1995)                    |                              |      | 32.07 |   |   |   |  |
| 2521 |                                                                                                                                           |   |                               |           | 95% Modified-t UCL (Johnson-1978)                   |                              |      | 31.68 |   |   |   |  |
| 2522 |                                                                                                                                           |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2523 | <b>Gamma GOF Test</b>                                                                                                                     |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2524 | A-D Test Statistic                                                                                                                        |   |                               | 1.11      | <b>Anderson-Darling Gamma GOF Test</b>              |                              |      |       |   |   |   |  |
| 2525 | 5% A-D Critical Value                                                                                                                     |   |                               | 0.757     | Data Not Gamma Distributed at 5% Significance Level |                              |      |       |   |   |   |  |
| 2526 | K-S Test Statistic                                                                                                                        |   |                               | 0.139     | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |                              |      |       |   |   |   |  |
| 2527 | 5% K-S Critical Value                                                                                                                     |   |                               | 0.122     | Data Not Gamma Distributed at 5% Significance Level |                              |      |       |   |   |   |  |
| 2528 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                                |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2529 |                                                                                                                                           |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2530 | <b>Gamma Statistics</b>                                                                                                                   |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2531 | k hat (MLE)                                                                                                                               |   |                               | 3.214     | k star (bias corrected MLE)                         |                              |      | 3.048 |   |   |   |  |
| 2532 | Theta hat (MLE)                                                                                                                           |   |                               | 8.67      | Theta star (bias corrected MLE)                     |                              |      | 9.143 |   |   |   |  |
| 2533 | nu hat (MLE)                                                                                                                              |   |                               | 347.1     | nu star (bias corrected)                            |                              |      | 329.2 |   |   |   |  |
| 2534 | MLE Mean (bias corrected)                                                                                                                 |   |                               | 27.86     | MLE Sd (bias corrected)                             |                              |      | 15.96 |   |   |   |  |
| 2535 |                                                                                                                                           |   |                               |           | Approximate Chi Square Value (0.05)                 |                              |      | 288.1 |   |   |   |  |
| 2536 | Adjusted Level of Significance                                                                                                            |   |                               | 0.0456    | Adjusted Chi Square Value                           |                              |      | 287.1 |   |   |   |  |
| 2537 |                                                                                                                                           |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2538 | <b>Assuming Gamma Distribution</b>                                                                                                        |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2539 | 95% Approximate Gamma UCL (use when n>=50))                                                                                               |   |                               | 31.83     | 95% Adjusted Gamma UCL (use when n<50)              |                              |      | 31.95 |   |   |   |  |
| 2540 |                                                                                                                                           |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2541 | <b>Lognormal GOF Test</b>                                                                                                                 |   |                               |           |                                                     |                              |      |       |   |   |   |  |
| 2542 | Shapiro Wilk Test Statistic                                                                                                               |   |                               | 0.922     | <b>Shapiro Wilk Lognormal GOF Test</b>              |                              |      |       |   |   |   |  |
| 2543 | 5% Shapiro Wilk P Value                                                                                                                   |   |                               | 0.00165   | Data Not Lognormal at 5% Significance Level         |                              |      |       |   |   |   |  |
| 2544 | Lilliefors Test Statistic                                                                                                                 |   |                               | 0.171     | <b>Lilliefors Lognormal GOF Test</b>                |                              |      |       |   |   |   |  |
| 2545 | 5% Lilliefors Critical Value                                                                                                              |   |                               | 0.12      | Data Not Lognormal at 5% Significance Level         |                              |      |       |   |   |   |  |
| 2546 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                        |   |                               |           |                                                     |                              |      |       |   |   |   |  |

| A    | B                                                                                                                                        | C | D | E         | F | G                                                               | H | I | J     | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|-----------|---|-----------------------------------------------------------------|---|---|-------|---|---|
| 2547 |                                                                                                                                          |   |   |           |   |                                                                 |   |   |       |   |   |
| 2548 | <b>Lognormal Statistics</b>                                                                                                              |   |   |           |   |                                                                 |   |   |       |   |   |
| 2549 | Minimum of Logged Data                                                                                                                   |   |   | 1.281     |   | Mean of logged Data                                             |   |   | 3.164 |   |   |
| 2550 | Maximum of Logged Data                                                                                                                   |   |   | 4.475     |   | SD of logged Data                                               |   |   | 0.613 |   |   |
| 2551 |                                                                                                                                          |   |   |           |   |                                                                 |   |   |       |   |   |
| 2552 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |           |   |                                                                 |   |   |       |   |   |
| 2553 | 95% H-UCL                                                                                                                                |   |   | 33.67     |   | 90% Chebyshev (MVUE) UCL                                        |   |   | 36.07 |   |   |
| 2554 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 39.54     |   | 97.5% Chebyshev (MVUE) UCL                                      |   |   | 44.34 |   |   |
| 2555 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 53.78     |   |                                                                 |   |   |       |   |   |
| 2556 |                                                                                                                                          |   |   |           |   |                                                                 |   |   |       |   |   |
| 2557 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |           |   |                                                                 |   |   |       |   |   |
| 2558 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |   |   |           |   |                                                                 |   |   |       |   |   |
| 2559 |                                                                                                                                          |   |   |           |   |                                                                 |   |   |       |   |   |
| 2560 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |           |   |                                                                 |   |   |       |   |   |
| 2561 | 95% CLT UCL                                                                                                                              |   |   | 31.53     |   | 95% Jackknife UCL                                               |   |   | 31.59 |   |   |
| 2562 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 31.41     |   | 95% Bootstrap-t UCL                                             |   |   | 32.63 |   |   |
| 2563 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 32.51     |   | 95% Percentile Bootstrap UCL                                    |   |   | 31.46 |   |   |
| 2564 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 31.99     |   |                                                                 |   |   |       |   |   |
| 2565 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 34.54     |   | 95% Chebyshev(Mean, Sd) UCL                                     |   |   | 37.57 |   |   |
| 2566 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 41.77     |   | 99% Chebyshev(Mean, Sd) UCL                                     |   |   | 50.01 |   |   |
| 2567 |                                                                                                                                          |   |   |           |   |                                                                 |   |   |       |   |   |
| 2568 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |           |   |                                                                 |   |   |       |   |   |
| 2569 | 95% Chebyshev (Mean, Sd) UCL                                                                                                             |   |   | 37.57     |   |                                                                 |   |   |       |   |   |
| 2570 |                                                                                                                                          |   |   |           |   |                                                                 |   |   |       |   |   |
| 2571 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |           |   |                                                                 |   |   |       |   |   |
| 2572 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |           |   |                                                                 |   |   |       |   |   |
| 2573 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |           |   |                                                                 |   |   |       |   |   |
| 2574 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |           |   |                                                                 |   |   |       |   |   |
| 2575 |                                                                                                                                          |   |   |           |   |                                                                 |   |   |       |   |   |
| 2576 |                                                                                                                                          |   |   |           |   |                                                                 |   |   |       |   |   |
| 2577 | <b>Result (eu9_cadmium)</b>                                                                                                              |   |   |           |   |                                                                 |   |   |       |   |   |
| 2578 |                                                                                                                                          |   |   |           |   |                                                                 |   |   |       |   |   |
| 2579 | <b>General Statistics</b>                                                                                                                |   |   |           |   |                                                                 |   |   |       |   |   |
| 2580 | Total Number of Observations                                                                                                             |   |   | 54        |   | Number of Distinct Observations                                 |   |   | 49    |   |   |
| 2581 |                                                                                                                                          |   |   |           |   | Number of Missing Observations                                  |   |   | 0     |   |   |
| 2582 | Minimum                                                                                                                                  |   |   | 2         |   | Mean                                                            |   |   | 10.79 |   |   |
| 2583 | Maximum                                                                                                                                  |   |   | 51.2      |   | Median                                                          |   |   | 9.685 |   |   |
| 2584 | SD                                                                                                                                       |   |   | 7.622     |   | Std. Error of Mean                                              |   |   | 1.037 |   |   |
| 2585 | Coefficient of Variation                                                                                                                 |   |   | 0.706     |   | Skewness                                                        |   |   | 3.146 |   |   |
| 2586 |                                                                                                                                          |   |   |           |   |                                                                 |   |   |       |   |   |
| 2587 | <b>Normal GOF Test</b>                                                                                                                   |   |   |           |   |                                                                 |   |   |       |   |   |
| 2588 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.741     |   | <b>Shapiro Wilk GOF Test</b>                                    |   |   |       |   |   |
| 2589 | 5% Shapiro Wilk P Value                                                                                                                  |   |   | 4.681E-12 |   | Data Not Normal at 5% Significance Level                        |   |   |       |   |   |
| 2590 | Lilliefors Test Statistic                                                                                                                |   |   | 0.198     |   | <b>Lilliefors GOF Test</b>                                      |   |   |       |   |   |
| 2591 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.12      |   | Data Not Normal at 5% Significance Level                        |   |   |       |   |   |
| 2592 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |           |   |                                                                 |   |   |       |   |   |
| 2593 |                                                                                                                                          |   |   |           |   |                                                                 |   |   |       |   |   |
| 2594 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |           |   |                                                                 |   |   |       |   |   |
| 2595 | <b>95% Normal UCL</b>                                                                                                                    |   |   |           |   | <b>95% UCLs (Adjusted for Skewness)</b>                         |   |   |       |   |   |
| 2596 | 95% Student's-t UCL                                                                                                                      |   |   | 12.53     |   | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   | 12.97 |   |   |
| 2597 |                                                                                                                                          |   |   |           |   | 95% Modified-t UCL (Johnson-1978)                               |   |   | 12.6  |   |   |
| 2598 |                                                                                                                                          |   |   |           |   |                                                                 |   |   |       |   |   |
| 2599 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |           |   |                                                                 |   |   |       |   |   |
| 2600 | A-D Test Statistic                                                                                                                       |   |   | 0.839     |   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |   |       |   |   |
| 2601 | 5% A-D Critical Value                                                                                                                    |   |   | 0.758     |   | Data Not Gamma Distributed at 5% Significance Level             |   |   |       |   |   |
| 2602 | K-S Test Statistic                                                                                                                       |   |   | 0.119     |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |   |       |   |   |
| 2603 | 5% K-S Critical Value                                                                                                                    |   |   | 0.122     |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |       |   |   |
| 2604 | <b>Detected data follow Appr. Gamma Distribution at 5% Significance Level</b>                                                            |   |   |           |   |                                                                 |   |   |       |   |   |
| 2605 |                                                                                                                                          |   |   |           |   |                                                                 |   |   |       |   |   |
| 2606 | <b>Gamma Statistics</b>                                                                                                                  |   |   |           |   |                                                                 |   |   |       |   |   |
| 2607 | k hat (MLE)                                                                                                                              |   |   | 2.965     |   | k star (bias corrected MLE)                                     |   |   | 2.813 |   |   |
| 2608 | Theta hat (MLE)                                                                                                                          |   |   | 3.64      |   | Theta star (bias corrected MLE)                                 |   |   | 3.837 |   |   |
| 2609 | nu hat (MLE)                                                                                                                             |   |   | 320.2     |   | nu star (bias corrected)                                        |   |   | 303.8 |   |   |
| 2610 | MLE Mean (bias corrected)                                                                                                                |   |   | 10.79     |   | MLE Sd (bias corrected)                                         |   |   | 6.435 |   |   |
| 2611 |                                                                                                                                          |   |   |           |   | Approximate Chi Square Value (0.05)                             |   |   | 264.4 |   |   |
| 2612 | Adjusted Level of Significance                                                                                                           |   |   | 0.0456    |   | Adjusted Chi Square Value                                       |   |   | 263.4 |   |   |
| 2613 |                                                                                                                                          |   |   |           |   |                                                                 |   |   |       |   |   |

| A    | B                                                                                                                                        | C | D | E     | F                                                   | G | H | I     | J | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|-------|-----------------------------------------------------|---|---|-------|---|---|---|--|
| 2614 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2615 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   |   | 12.4  | 95% Adjusted Gamma UCL (use when n<50)              |   |   | 12.45 |   |   |   |  |
| 2616 |                                                                                                                                          |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2617 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2618 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.97  | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |   |       |   |   |   |  |
| 2619 | 5% Shapiro Wilk P Value                                                                                                                  |   |   | 0.346 | Data appear Lognormal at 5% Significance Level      |   |   |       |   |   |   |  |
| 2620 | Lilliefors Test Statistic                                                                                                                |   |   | 0.109 | <b>Lilliefors Lognormal GOF Test</b>                |   |   |       |   |   |   |  |
| 2621 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.12  | Data appear Lognormal at 5% Significance Level      |   |   |       |   |   |   |  |
| 2622 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2623 |                                                                                                                                          |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2624 | <b>Lognormal Statistics</b>                                                                                                              |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2625 | Minimum of Logged Data                                                                                                                   |   |   | 0.693 | Mean of logged Data                                 |   |   | 2.201 |   |   |   |  |
| 2626 | Maximum of Logged Data                                                                                                                   |   |   | 3.936 | SD of logged Data                                   |   |   | 0.601 |   |   |   |  |
| 2627 |                                                                                                                                          |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2628 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2629 | 95% H-UCL                                                                                                                                |   |   | 12.71 | 90% Chebyshev (MVUE) UCL                            |   |   | 13.61 |   |   |   |  |
| 2630 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 14.9  | 97.5% Chebyshev (MVUE) UCL                          |   |   | 16.68 |   |   |   |  |
| 2631 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 20.18 |                                                     |   |   |       |   |   |   |  |
| 2632 |                                                                                                                                          |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2633 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2634 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2635 |                                                                                                                                          |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2636 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2637 | 95% CLT UCL                                                                                                                              |   |   | 12.5  | 95% Jackknife UCL                                   |   |   | 12.53 |   |   |   |  |
| 2638 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 12.46 | 95% Bootstrap-t UCL                                 |   |   | 13.43 |   |   |   |  |
| 2639 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 15.22 | 95% Percentile Bootstrap UCL                        |   |   | 12.57 |   |   |   |  |
| 2640 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 13.12 |                                                     |   |   |       |   |   |   |  |
| 2641 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 13.9  | 95% Chebyshev(Mean, Sd) UCL                         |   |   | 15.31 |   |   |   |  |
| 2642 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 17.27 | 99% Chebyshev(Mean, Sd) UCL                         |   |   | 21.11 |   |   |   |  |
| 2643 |                                                                                                                                          |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2644 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2645 | 95% Approximate Gamma UCL                                                                                                                |   |   | 12.4  |                                                     |   |   |       |   |   |   |  |
| 2646 |                                                                                                                                          |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2647 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                           |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2648 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                   |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2649 |                                                                                                                                          |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2650 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2651 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2652 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2653 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2654 |                                                                                                                                          |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2655 |                                                                                                                                          |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2656 | <b>Result (eu9_chromium)</b>                                                                                                             |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2657 |                                                                                                                                          |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2658 | <b>General Statistics</b>                                                                                                                |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2659 | Total Number of Observations                                                                                                             |   |   | 54    | Number of Distinct Observations                     |   |   | 43    |   |   |   |  |
| 2660 |                                                                                                                                          |   |   |       | Number of Missing Observations                      |   |   | 0     |   |   |   |  |
| 2661 | Minimum                                                                                                                                  |   |   | 1.9   | Mean                                                |   |   | 4.413 |   |   |   |  |
| 2662 | Maximum                                                                                                                                  |   |   | 37.3  | Median                                              |   |   | 3.8   |   |   |   |  |
| 2663 | SD                                                                                                                                       |   |   | 4.64  | Std. Error of Mean                                  |   |   | 0.631 |   |   |   |  |
| 2664 | Coefficient of Variation                                                                                                                 |   |   | 1.052 | Skewness                                            |   |   | 6.959 |   |   |   |  |
| 2665 |                                                                                                                                          |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2666 | <b>Normal GOF Test</b>                                                                                                                   |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2667 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.286 | <b>Shapiro Wilk GOF Test</b>                        |   |   |       |   |   |   |  |
| 2668 | 5% Shapiro Wilk P Value                                                                                                                  |   |   | 0     | Data Not Normal at 5% Significance Level            |   |   |       |   |   |   |  |
| 2669 | Lilliefors Test Statistic                                                                                                                |   |   | 0.38  | <b>Lilliefors GOF Test</b>                          |   |   |       |   |   |   |  |
| 2670 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.12  | Data Not Normal at 5% Significance Level            |   |   |       |   |   |   |  |
| 2671 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2672 |                                                                                                                                          |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2673 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2674 | <b>95% Normal UCL</b>                                                                                                                    |   |   |       | <b>95% UCLs (Adjusted for Skewness)</b>             |   |   |       |   |   |   |  |
| 2675 | 95% Student's-t UCL                                                                                                                      |   |   | 5.47  | 95% Adjusted-CLT UCL (Chen-1995)                    |   |   | 6.09  |   |   |   |  |
| 2676 |                                                                                                                                          |   |   |       | 95% Modified-t UCL (Johnson-1978)                   |   |   | 5.569 |   |   |   |  |
| 2677 |                                                                                                                                          |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2678 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |       |                                                     |   |   |       |   |   |   |  |
| 2679 | A-D Test Statistic                                                                                                                       |   |   | 6.106 | <b>Anderson-Darling Gamma GOF Test</b>              |   |   |       |   |   |   |  |
| 2680 | 5% A-D Critical Value                                                                                                                    |   |   | 0.754 | Data Not Gamma Distributed at 5% Significance Level |   |   |       |   |   |   |  |

| A    | B                                                                                                                                        | C | D         | E                                                   | F | G       | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|-----------|-----------------------------------------------------|---|---------|---|---|---|---|---|
| 2681 | K-S Test Statistic                                                                                                                       |   | 0.248     | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |         |   |   |   |   |   |
| 2682 | 5% K-S Critical Value                                                                                                                    |   | 0.122     | Data Not Gamma Distributed at 5% Significance Level |   |         |   |   |   |   |   |
| 2683 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |           |                                                     |   |         |   |   |   |   |   |
| 2684 |                                                                                                                                          |   |           |                                                     |   |         |   |   |   |   |   |
| 2685 | <b>Gamma Statistics</b>                                                                                                                  |   |           |                                                     |   |         |   |   |   |   |   |
| 2686 | k hat (MLE)                                                                                                                              |   | 3.811     | k star (bias corrected MLE)                         |   | 3.611   |   |   |   |   |   |
| 2687 | Theta hat (MLE)                                                                                                                          |   | 1.158     | Theta star (bias corrected MLE)                     |   | 1.222   |   |   |   |   |   |
| 2688 | nu hat (MLE)                                                                                                                             |   | 411.5     | nu star (bias corrected)                            |   | 390     |   |   |   |   |   |
| 2689 | MLE Mean (bias corrected)                                                                                                                |   | 4.413     | MLE Sd (bias corrected)                             |   | 2.322   |   |   |   |   |   |
| 2690 |                                                                                                                                          |   |           | Approximate Chi Square Value (0.05)                 |   | 345.2   |   |   |   |   |   |
| 2691 | Adjusted Level of Significance                                                                                                           |   | 0.0456    | Adjusted Chi Square Value                           |   | 344.1   |   |   |   |   |   |
| 2692 |                                                                                                                                          |   |           |                                                     |   |         |   |   |   |   |   |
| 2693 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |           |                                                     |   |         |   |   |   |   |   |
| 2694 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   | 4.985     | 95% Adjusted Gamma UCL (use when n<50)              |   | 5.002   |   |   |   |   |   |
| 2695 |                                                                                                                                          |   |           |                                                     |   |         |   |   |   |   |   |
| 2696 | <b>Lognormal GOF Test</b>                                                                                                                |   |           |                                                     |   |         |   |   |   |   |   |
| 2697 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.727     | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |         |   |   |   |   |   |
| 2698 | 5% Shapiro Wilk P Value                                                                                                                  |   | 1.143E-12 | Data Not Lognormal at 5% Significance Level         |   |         |   |   |   |   |   |
| 2699 | Lilliefors Test Statistic                                                                                                                |   | 0.164     | <b>Lilliefors Lognormal GOF Test</b>                |   |         |   |   |   |   |   |
| 2700 | 5% Lilliefors Critical Value                                                                                                             |   | 0.12      | Data Not Lognormal at 5% Significance Level         |   |         |   |   |   |   |   |
| 2701 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |   |           |                                                     |   |         |   |   |   |   |   |
| 2702 |                                                                                                                                          |   |           |                                                     |   |         |   |   |   |   |   |
| 2703 | <b>Lognormal Statistics</b>                                                                                                              |   |           |                                                     |   |         |   |   |   |   |   |
| 2704 | Minimum of Logged Data                                                                                                                   |   | 0.642     | Mean of logged Data                                 |   | 1.348   |   |   |   |   |   |
| 2705 | Maximum of Logged Data                                                                                                                   |   | 3.619     | SD of logged Data                                   |   | 0.399   |   |   |   |   |   |
| 2706 |                                                                                                                                          |   |           |                                                     |   |         |   |   |   |   |   |
| 2707 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |           |                                                     |   |         |   |   |   |   |   |
| 2708 | 95% H-UCL                                                                                                                                |   | 4.602     | 90% Chebyshev (MVUE) UCL                            |   | 4.86    |   |   |   |   |   |
| 2709 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 5.177     | 97.5% Chebyshev (MVUE) UCL                          |   | 5.617   |   |   |   |   |   |
| 2710 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 6.482     |                                                     |   |         |   |   |   |   |   |
| 2711 |                                                                                                                                          |   |           |                                                     |   |         |   |   |   |   |   |
| 2712 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |           |                                                     |   |         |   |   |   |   |   |
| 2713 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |   |           |                                                     |   |         |   |   |   |   |   |
| 2714 |                                                                                                                                          |   |           |                                                     |   |         |   |   |   |   |   |
| 2715 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |           |                                                     |   |         |   |   |   |   |   |
| 2716 | 95% CLT UCL                                                                                                                              |   | 5.451     | 95% Jackknife UCL                                   |   | 5.47    |   |   |   |   |   |
| 2717 | 95% Standard Bootstrap UCL                                                                                                               |   | 5.45      | 95% Bootstrap-t UCL                                 |   | 8.662   |   |   |   |   |   |
| 2718 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 9.953     | 95% Percentile Bootstrap UCL                        |   | 5.671   |   |   |   |   |   |
| 2719 | 95% BCA Bootstrap UCL                                                                                                                    |   | 6.406     |                                                     |   |         |   |   |   |   |   |
| 2720 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 6.307     | 95% Chebyshev(Mean, Sd) UCL                         |   | 7.165   |   |   |   |   |   |
| 2721 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 8.356     | 99% Chebyshev(Mean, Sd) UCL                         |   | 10.7    |   |   |   |   |   |
| 2722 |                                                                                                                                          |   |           |                                                     |   |         |   |   |   |   |   |
| 2723 | <b>Suggested UCL to Use</b>                                                                                                              |   |           |                                                     |   |         |   |   |   |   |   |
| 2724 | 95% Student's-t UCL                                                                                                                      |   | 5.47      | or 95% Modified-t UCL                               |   | 5.569   |   |   |   |   |   |
| 2725 |                                                                                                                                          |   |           |                                                     |   |         |   |   |   |   |   |
| 2726 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |           |                                                     |   |         |   |   |   |   |   |
| 2727 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |           |                                                     |   |         |   |   |   |   |   |
| 2728 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |           |                                                     |   |         |   |   |   |   |   |
| 2729 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |           |                                                     |   |         |   |   |   |   |   |
| 2730 |                                                                                                                                          |   |           |                                                     |   |         |   |   |   |   |   |
| 2731 |                                                                                                                                          |   |           |                                                     |   |         |   |   |   |   |   |
| 2732 | <b>Result (eu9_cobalt)</b>                                                                                                               |   |           |                                                     |   |         |   |   |   |   |   |
| 2733 |                                                                                                                                          |   |           |                                                     |   |         |   |   |   |   |   |
| 2734 | <b>General Statistics</b>                                                                                                                |   |           |                                                     |   |         |   |   |   |   |   |
| 2735 | Total Number of Observations                                                                                                             |   | 39        | Number of Distinct Observations                     |   | 32      |   |   |   |   |   |
| 2736 |                                                                                                                                          |   |           | Number of Missing Observations                      |   | 0       |   |   |   |   |   |
| 2737 | Minimum                                                                                                                                  |   | 3.9       | Mean                                                |   | 11.53   |   |   |   |   |   |
| 2738 | Maximum                                                                                                                                  |   | 20        | Median                                              |   | 12      |   |   |   |   |   |
| 2739 | SD                                                                                                                                       |   | 3.595     | Std. Error of Mean                                  |   | 0.576   |   |   |   |   |   |
| 2740 | Coefficient of Variation                                                                                                                 |   | 0.312     | Skewness                                            |   | -0.0971 |   |   |   |   |   |
| 2741 |                                                                                                                                          |   |           |                                                     |   |         |   |   |   |   |   |
| 2742 | <b>Normal GOF Test</b>                                                                                                                   |   |           |                                                     |   |         |   |   |   |   |   |
| 2743 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.979     | <b>Shapiro Wilk GOF Test</b>                        |   |         |   |   |   |   |   |
| 2744 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.939     | Data appear Normal at 5% Significance Level         |   |         |   |   |   |   |   |
| 2745 | Lilliefors Test Statistic                                                                                                                |   | 0.101     | <b>Lilliefors GOF Test</b>                          |   |         |   |   |   |   |   |
| 2746 | 5% Lilliefors Critical Value                                                                                                             |   | 0.14      | Data appear Normal at 5% Significance Level         |   |         |   |   |   |   |   |
| 2747 | <b>Data appear Normal at 5% Significance Level</b>                                                                                       |   |           |                                                     |   |         |   |   |   |   |   |

| A    | B                                                                                                                                       | C | D | E      | F     | G                                                   | H                                      | I | J | K     | L    |  |
|------|-----------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|-------|-----------------------------------------------------|----------------------------------------|---|---|-------|------|--|
| 2748 |                                                                                                                                         |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2749 | <b>Assuming Normal Distribution</b>                                                                                                     |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2750 | <b>95% Normal UCL</b>                                                                                                                   |   |   |        |       | <b>95% UCLs (Adjusted for Skewness)</b>             |                                        |   |   |       |      |  |
| 2751 | 95% Student's-t UCL                                                                                                                     |   |   | 12.5   |       | 95% Adjusted-CLT UCL (Chen-1995)                    |                                        |   |   | 12.47 |      |  |
| 2752 |                                                                                                                                         |   |   |        |       | 95% Modified-t UCL (Johnson-1978)                   |                                        |   |   | 12.5  |      |  |
| 2753 |                                                                                                                                         |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2754 | <b>Gamma GOF Test</b>                                                                                                                   |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2755 | A-D Test Statistic                                                                                                                      |   |   | 0.767  |       | <b>Anderson-Darling Gamma GOF Test</b>              |                                        |   |   |       |      |  |
| 2756 | 5% A-D Critical Value                                                                                                                   |   |   | 0.749  |       | Data Not Gamma Distributed at 5% Significance Level |                                        |   |   |       |      |  |
| 2757 | K-S Test Statistic                                                                                                                      |   |   | 0.146  |       | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |                                        |   |   |       |      |  |
| 2758 | 5% K-S Critical Value                                                                                                                   |   |   | 0.141  |       | Data Not Gamma Distributed at 5% Significance Level |                                        |   |   |       |      |  |
| 2759 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                              |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2760 |                                                                                                                                         |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2761 | <b>Gamma Statistics</b>                                                                                                                 |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2762 | k hat (MLE)                                                                                                                             |   |   | 9.106  |       | k star (bias corrected MLE)                         |                                        |   |   | 8.423 |      |  |
| 2763 | Theta hat (MLE)                                                                                                                         |   |   | 1.266  |       | Theta star (bias corrected MLE)                     |                                        |   |   | 1.369 |      |  |
| 2764 | nu hat (MLE)                                                                                                                            |   |   | 710.3  |       | nu star (bias corrected)                            |                                        |   |   | 657   |      |  |
| 2765 | MLE Mean (bias corrected)                                                                                                               |   |   | 11.53  |       | MLE Sd (bias corrected)                             |                                        |   |   | 3.973 |      |  |
| 2766 |                                                                                                                                         |   |   |        |       | Approximate Chi Square Value (0.05)                 |                                        |   |   | 598.5 |      |  |
| 2767 | Adjusted Level of Significance                                                                                                          |   |   | 0.0437 |       | Adjusted Chi Square Value                           |                                        |   |   | 596.3 |      |  |
| 2768 |                                                                                                                                         |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2769 | <b>Assuming Gamma Distribution</b>                                                                                                      |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2770 | 95% Approximate Gamma UCL (use when n>=50))                                                                                             |   |   |        | 12.66 |                                                     | 95% Adjusted Gamma UCL (use when n<50) |   |   |       | 12.7 |  |
| 2771 |                                                                                                                                         |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2772 | <b>Lognormal GOF Test</b>                                                                                                               |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2773 | Shapiro Wilk Test Statistic                                                                                                             |   |   | 0.929  |       | <b>Shapiro Wilk Lognormal GOF Test</b>              |                                        |   |   |       |      |  |
| 2774 | 5% Shapiro Wilk Critical Value                                                                                                          |   |   | 0.939  |       | Data Not Lognormal at 5% Significance Level         |                                        |   |   |       |      |  |
| 2775 | Lilliefors Test Statistic                                                                                                               |   |   | 0.165  |       | <b>Lilliefors Lognormal GOF Test</b>                |                                        |   |   |       |      |  |
| 2776 | 5% Lilliefors Critical Value                                                                                                            |   |   | 0.14   |       | Data Not Lognormal at 5% Significance Level         |                                        |   |   |       |      |  |
| 2777 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                      |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2778 |                                                                                                                                         |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2779 | <b>Lognormal Statistics</b>                                                                                                             |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2780 | Minimum of Logged Data                                                                                                                  |   |   | 1.361  |       | Mean of logged Data                                 |                                        |   |   | 2.389 |      |  |
| 2781 | Maximum of Logged Data                                                                                                                  |   |   | 2.996  |       | SD of logged Data                                   |                                        |   |   | 0.357 |      |  |
| 2782 |                                                                                                                                         |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2783 | <b>Assuming Lognormal Distribution</b>                                                                                                  |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2784 | 95% H-UCL                                                                                                                               |   |   | 12.92  |       | 90% Chebyshev (MVUE) UCL                            |                                        |   |   | 13.64 |      |  |
| 2785 | 95% Chebyshev (MVUE) UCL                                                                                                                |   |   | 14.57  |       | 97.5% Chebyshev (MVUE) UCL                          |                                        |   |   | 15.85 |      |  |
| 2786 | 99% Chebyshev (MVUE) UCL                                                                                                                |   |   | 18.37  |       |                                                     |                                        |   |   |       |      |  |
| 2787 |                                                                                                                                         |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2788 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                   |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2789 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                        |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2790 |                                                                                                                                         |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2791 | <b>Nonparametric Distribution Free UCLs</b>                                                                                             |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2792 | 95% CLT UCL                                                                                                                             |   |   | 12.48  |       | 95% Jackknife UCL                                   |                                        |   |   | 12.5  |      |  |
| 2793 | 95% Standard Bootstrap UCL                                                                                                              |   |   | 12.48  |       | 95% Bootstrap-t UCL                                 |                                        |   |   | 12.49 |      |  |
| 2794 | 95% Hall's Bootstrap UCL                                                                                                                |   |   | 12.41  |       | 95% Percentile Bootstrap UCL                        |                                        |   |   | 12.44 |      |  |
| 2795 | 95% BCA Bootstrap UCL                                                                                                                   |   |   | 12.46  |       |                                                     |                                        |   |   |       |      |  |
| 2796 | 90% Chebyshev(Mean, Sd) UCL                                                                                                             |   |   | 13.26  |       | 95% Chebyshev(Mean, Sd) UCL                         |                                        |   |   | 14.04 |      |  |
| 2797 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                           |   |   | 15.13  |       | 99% Chebyshev(Mean, Sd) UCL                         |                                        |   |   | 17.26 |      |  |
| 2798 |                                                                                                                                         |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2799 | <b>Suggested UCL to Use</b>                                                                                                             |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2800 | 95% Student's-t UCL                                                                                                                     |   |   | 12.5   |       |                                                     |                                        |   |   |       |      |  |
| 2801 |                                                                                                                                         |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2802 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.            |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2803 | Recommendations are based upon data size, data distribution, and skewness.                                                              |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2804 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2805 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statisticia |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2806 |                                                                                                                                         |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2807 | <b>Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be</b>                |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2808 | <b>reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.</b>                                      |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2809 |                                                                                                                                         |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2810 |                                                                                                                                         |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2811 | <b>Result (eu9_copper)</b>                                                                                                              |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2812 |                                                                                                                                         |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2813 | <b>General Statistics</b>                                                                                                               |   |   |        |       |                                                     |                                        |   |   |       |      |  |
| 2814 | Total Number of Observations                                                                                                            |   |   | 54     |       | Number of Distinct Observations                     |                                        |   |   | 52    |      |  |

|      | A                                                                                                                            | B | C | D | E                                           | F         | G | H | I | J | K                                                   | L     |
|------|------------------------------------------------------------------------------------------------------------------------------|---|---|---|---------------------------------------------|-----------|---|---|---|---|-----------------------------------------------------|-------|
| 2815 |                                                                                                                              |   |   |   |                                             |           |   |   |   |   | Number of Missing Observations                      | 0     |
| 2816 |                                                                                                                              |   |   |   | Minimum                                     | 61.5      |   |   |   |   | Mean                                                | 376.4 |
| 2817 |                                                                                                                              |   |   |   | Maximum                                     | 2680      |   |   |   |   | Median                                              | 303   |
| 2818 |                                                                                                                              |   |   |   | SD                                          | 378.3     |   |   |   |   | Std. Error of Mean                                  | 51.48 |
| 2819 |                                                                                                                              |   |   |   | Coefficient of Variation                    | 1.005     |   |   |   |   | Skewness                                            | 4.819 |
| 2820 |                                                                                                                              |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2821 | <b>Normal GOF Test</b>                                                                                                       |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2822 |                                                                                                                              |   |   |   | Shapiro Wilk Test Statistic                 | 0.507     |   |   |   |   | <b>Shapiro Wilk GOF Test</b>                        |       |
| 2823 |                                                                                                                              |   |   |   | 5% Shapiro Wilk P Value                     | 0         |   |   |   |   | Data Not Normal at 5% Significance Level            |       |
| 2824 |                                                                                                                              |   |   |   | Lilliefors Test Statistic                   | 0.312     |   |   |   |   | <b>Lilliefors GOF Test</b>                          |       |
| 2825 |                                                                                                                              |   |   |   | 5% Lilliefors Critical Value                | 0.12      |   |   |   |   | Data Not Normal at 5% Significance Level            |       |
| 2826 | <b>Data Not Normal at 5% Significance Level</b>                                                                              |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2827 |                                                                                                                              |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2828 | <b>Assuming Normal Distribution</b>                                                                                          |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2829 |                                                                                                                              |   |   |   | <b>95% Normal UCL</b>                       |           |   |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b>             |       |
| 2830 |                                                                                                                              |   |   |   | 95% Student's-t UCL                         | 462.6     |   |   |   |   | 95% Adjusted-CLT UCL (Chen-1995)                    | 497.2 |
| 2831 |                                                                                                                              |   |   |   |                                             |           |   |   |   |   | 95% Modified-t UCL (Johnson-1978)                   | 468.2 |
| 2832 |                                                                                                                              |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2833 | <b>Gamma GOF Test</b>                                                                                                        |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2834 |                                                                                                                              |   |   |   | A-D Test Statistic                          | 3.109     |   |   |   |   | <b>Anderson-Darling Gamma GOF Test</b>              |       |
| 2835 |                                                                                                                              |   |   |   | 5% A-D Critical Value                       | 0.76      |   |   |   |   | Data Not Gamma Distributed at 5% Significance Level |       |
| 2836 |                                                                                                                              |   |   |   | K-S Test Statistic                          | 0.203     |   |   |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |       |
| 2837 |                                                                                                                              |   |   |   | 5% K-S Critical Value                       | 0.122     |   |   |   |   | Data Not Gamma Distributed at 5% Significance Level |       |
| 2838 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2839 |                                                                                                                              |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2840 | <b>Gamma Statistics</b>                                                                                                      |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2841 |                                                                                                                              |   |   |   | k hat (MLE)                                 | 2.443     |   |   |   |   | k star (bias corrected MLE)                         | 2.32  |
| 2842 |                                                                                                                              |   |   |   | Theta hat (MLE)                             | 154.1     |   |   |   |   | Theta star (bias corrected MLE)                     | 162.3 |
| 2843 |                                                                                                                              |   |   |   | nu hat (MLE)                                | 263.8     |   |   |   |   | nu star (bias corrected)                            | 250.5 |
| 2844 |                                                                                                                              |   |   |   | MLE Mean (bias corrected)                   | 376.4     |   |   |   |   | MLE Sd (bias corrected)                             | 247.1 |
| 2845 |                                                                                                                              |   |   |   |                                             |           |   |   |   |   | Approximate Chi Square Value (0.05)                 | 214.9 |
| 2846 |                                                                                                                              |   |   |   | Adjusted Level of Significance              | 0.0456    |   |   |   |   | Adjusted Chi Square Value                           | 214   |
| 2847 |                                                                                                                              |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2848 | <b>Assuming Gamma Distribution</b>                                                                                           |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2849 |                                                                                                                              |   |   |   | 95% Approximate Gamma UCL (use when n>=50)) | 438.9     |   |   |   |   | 95% Adjusted Gamma UCL (use when n<50)              | 440.7 |
| 2850 |                                                                                                                              |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2851 | <b>Lognormal GOF Test</b>                                                                                                    |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2852 |                                                                                                                              |   |   |   | Shapiro Wilk Test Statistic                 | 0.911     |   |   |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>              |       |
| 2853 |                                                                                                                              |   |   |   | 5% Shapiro Wilk P Value                     | 4.5260E-4 |   |   |   |   | Data Not Lognormal at 5% Significance Level         |       |
| 2854 |                                                                                                                              |   |   |   | Lilliefors Test Statistic                   | 0.149     |   |   |   |   | <b>Lilliefors Lognormal GOF Test</b>                |       |
| 2855 |                                                                                                                              |   |   |   | 5% Lilliefors Critical Value                | 0.12      |   |   |   |   | Data Not Lognormal at 5% Significance Level         |       |
| 2856 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                           |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2857 |                                                                                                                              |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2858 | <b>Lognormal Statistics</b>                                                                                                  |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2859 |                                                                                                                              |   |   |   | Minimum of Logged Data                      | 4.119     |   |   |   |   | Mean of logged Data                                 | 5.712 |
| 2860 |                                                                                                                              |   |   |   | Maximum of Logged Data                      | 7.894     |   |   |   |   | SD of logged Data                                   | 0.607 |
| 2861 |                                                                                                                              |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2862 | <b>Assuming Lognormal Distribution</b>                                                                                       |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2863 |                                                                                                                              |   |   |   | 95% H-UCL                                   | 428.1     |   |   |   |   | 90% Chebyshev (MVUE) UCL                            | 458.6 |
| 2864 |                                                                                                                              |   |   |   | 95% Chebyshev (MVUE) UCL                    | 502.2     |   |   |   |   | 97.5% Chebyshev (MVUE) UCL                          | 562.8 |
| 2865 |                                                                                                                              |   |   |   | 99% Chebyshev (MVUE) UCL                    | 681.7     |   |   |   |   |                                                     |       |
| 2866 |                                                                                                                              |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2867 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                        |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2868 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                  |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2869 |                                                                                                                              |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2870 | <b>Nonparametric Distribution Free UCLs</b>                                                                                  |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2871 |                                                                                                                              |   |   |   | 95% CLT UCL                                 | 461.1     |   |   |   |   | 95% Jackknife UCL                                   | 462.6 |
| 2872 |                                                                                                                              |   |   |   | 95% Standard Bootstrap UCL                  | 461.4     |   |   |   |   | 95% Bootstrap-t UCL                                 | 587.1 |
| 2873 |                                                                                                                              |   |   |   | 95% Hall's Bootstrap UCL                    | 861.6     |   |   |   |   | 95% Percentile Bootstrap UCL                        | 465.7 |
| 2874 |                                                                                                                              |   |   |   | 95% BCA Bootstrap UCL                       | 502.8     |   |   |   |   |                                                     |       |
| 2875 |                                                                                                                              |   |   |   | 90% Chebyshev(Mean, Sd) UCL                 | 530.9     |   |   |   |   | 95% Chebyshev(Mean, Sd) UCL                         | 600.8 |
| 2876 |                                                                                                                              |   |   |   | 97.5% Chebyshev(Mean, Sd) UCL               | 697.9     |   |   |   |   | 99% Chebyshev(Mean, Sd) UCL                         | 888.6 |
| 2877 |                                                                                                                              |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2878 | <b>Suggested UCL to Use</b>                                                                                                  |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2879 |                                                                                                                              |   |   |   | 95% Chebyshev (Mean, Sd) UCL                | 600.8     |   |   |   |   |                                                     |       |
| 2880 |                                                                                                                              |   |   |   |                                             |           |   |   |   |   |                                                     |       |
| 2881 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. |   |   |   |                                             |           |   |   |   |   |                                                     |       |

| A    | B                                                                                                                                      | C       | D                                                             | E | F     | G                                       | H | I | J | K | L |
|------|----------------------------------------------------------------------------------------------------------------------------------------|---------|---------------------------------------------------------------|---|-------|-----------------------------------------|---|---|---|---|---|
| 2882 | Recommendations are based upon data size, data distribution, and skewness.                                                             |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2883 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).               |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2884 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistica |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2885 |                                                                                                                                        |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2886 |                                                                                                                                        |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2887 | <b>Result (eu9_iron)</b>                                                                                                               |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2888 |                                                                                                                                        |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2889 | <b>General Statistics</b>                                                                                                              |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2890 | Total Number of Observations                                                                                                           | 54      | Number of Distinct Observations                               |   | 49    |                                         |   |   |   |   |   |
| 2891 |                                                                                                                                        |         | Number of Missing Observations                                |   | 0     |                                         |   |   |   |   |   |
| 2892 | Minimum                                                                                                                                | 19300   | Mean                                                          |   | 26626 |                                         |   |   |   |   |   |
| 2893 | Maximum                                                                                                                                | 41300   | Median                                                        |   | 25300 |                                         |   |   |   |   |   |
| 2894 | SD                                                                                                                                     | 5077    | Std. Error of Mean                                            |   | 690.8 |                                         |   |   |   |   |   |
| 2895 | Coefficient of Variation                                                                                                               | 0.191   | Skewness                                                      |   | 0.979 |                                         |   |   |   |   |   |
| 2896 |                                                                                                                                        |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2897 | <b>Normal GOF Test</b>                                                                                                                 |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2898 | Shapiro Wilk Test Statistic                                                                                                            | 0.926   | <b>Shapiro Wilk GOF Test</b>                                  |   |       |                                         |   |   |   |   |   |
| 2899 | 5% Shapiro Wilk P Value                                                                                                                | 0.00261 | Data Not Normal at 5% Significance Level                      |   |       |                                         |   |   |   |   |   |
| 2900 | Lilliefors Test Statistic                                                                                                              | 0.114   | <b>Lilliefors GOF Test</b>                                    |   |       |                                         |   |   |   |   |   |
| 2901 | 5% Lilliefors Critical Value                                                                                                           | 0.12    | Data appear Normal at 5% Significance Level                   |   |       |                                         |   |   |   |   |   |
| 2902 | <b>Data appear Approximate Normal at 5% Significance Level</b>                                                                         |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2903 |                                                                                                                                        |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2904 | <b>Assuming Normal Distribution</b>                                                                                                    |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2905 | <b>95% Normal UCL</b>                                                                                                                  |         |                                                               |   |       | <b>95% UCLs (Adjusted for Skewness)</b> |   |   |   |   |   |
| 2906 | 95% Student's-t UCL                                                                                                                    | 27782   | 95% Adjusted-CLT UCL (Chen-1995)                              |   | 27861 |                                         |   |   |   |   |   |
| 2907 |                                                                                                                                        |         | 95% Modified-t UCL (Johnson-1978)                             |   | 27798 |                                         |   |   |   |   |   |
| 2908 |                                                                                                                                        |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2909 | <b>Gamma GOF Test</b>                                                                                                                  |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2910 | A-D Test Statistic                                                                                                                     | 0.551   | <b>Anderson-Darling Gamma GOF Test</b>                        |   |       |                                         |   |   |   |   |   |
| 2911 | 5% A-D Critical Value                                                                                                                  | 0.748   | detected data appear Gamma Distributed at 5% Significance Lev |   |       |                                         |   |   |   |   |   |
| 2912 | K-S Test Statistic                                                                                                                     | 0.0963  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                      |   |       |                                         |   |   |   |   |   |
| 2913 | 5% K-S Critical Value                                                                                                                  | 0.121   | detected data appear Gamma Distributed at 5% Significance Lev |   |       |                                         |   |   |   |   |   |
| 2914 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                 |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2915 |                                                                                                                                        |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2916 | <b>Gamma Statistics</b>                                                                                                                |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2917 | k hat (MLE)                                                                                                                            | 30.24   | k star (bias corrected MLE)                                   |   | 28.58 |                                         |   |   |   |   |   |
| 2918 | Theta hat (MLE)                                                                                                                        | 880.4   | Theta star (bias corrected MLE)                               |   | 931.7 |                                         |   |   |   |   |   |
| 2919 | nu hat (MLE)                                                                                                                           | 3266    | nu star (bias corrected)                                      |   | 3086  |                                         |   |   |   |   |   |
| 2920 | MLE Mean (bias corrected)                                                                                                              | 26626   | MLE Sd (bias corrected)                                       |   | 4981  |                                         |   |   |   |   |   |
| 2921 |                                                                                                                                        |         | Approximate Chi Square Value (0.05)                           |   | 2958  |                                         |   |   |   |   |   |
| 2922 | Adjusted Level of Significance                                                                                                         | 0.0456  | Adjusted Chi Square Value                                     |   | 2955  |                                         |   |   |   |   |   |
| 2923 |                                                                                                                                        |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2924 | <b>Assuming Gamma Distribution</b>                                                                                                     |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2925 | 95% Approximate Gamma UCL (use when n>=50))                                                                                            | 27779   | 95% Adjusted Gamma UCL (use when n<50)                        |   | 27811 |                                         |   |   |   |   |   |
| 2926 |                                                                                                                                        |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2927 | <b>Lognormal GOF Test</b>                                                                                                              |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2928 | Shapiro Wilk Test Statistic                                                                                                            | 0.962   | <b>Shapiro Wilk Lognormal GOF Test</b>                        |   |       |                                         |   |   |   |   |   |
| 2929 | 5% Shapiro Wilk P Value                                                                                                                | 0.16    | Data appear Lognormal at 5% Significance Level                |   |       |                                         |   |   |   |   |   |
| 2930 | Lilliefors Test Statistic                                                                                                              | 0.0853  | <b>Lilliefors Lognormal GOF Test</b>                          |   |       |                                         |   |   |   |   |   |
| 2931 | 5% Lilliefors Critical Value                                                                                                           | 0.12    | Data appear Lognormal at 5% Significance Level                |   |       |                                         |   |   |   |   |   |
| 2932 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                  |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2933 |                                                                                                                                        |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2934 | <b>Lognormal Statistics</b>                                                                                                            |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2935 | Minimum of Logged Data                                                                                                                 | 9.868   | Mean of logged Data                                           |   | 10.17 |                                         |   |   |   |   |   |
| 2936 | Maximum of Logged Data                                                                                                                 | 10.63   | SD of logged Data                                             |   | 0.181 |                                         |   |   |   |   |   |
| 2937 |                                                                                                                                        |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2938 | <b>Assuming Lognormal Distribution</b>                                                                                                 |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2939 | 95% H-UCL                                                                                                                              | 27785   | 90% Chebyshev (MVUE) UCL                                      |   | 28597 |                                         |   |   |   |   |   |
| 2940 | 95% Chebyshev (MVUE) UCL                                                                                                               | 29496   | 97.5% Chebyshev (MVUE) UCL                                    |   | 30744 |                                         |   |   |   |   |   |
| 2941 | 99% Chebyshev (MVUE) UCL                                                                                                               | 33194   |                                                               |   |       |                                         |   |   |   |   |   |
| 2942 |                                                                                                                                        |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2943 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                  |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2944 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                       |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2945 |                                                                                                                                        |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2946 | <b>Nonparametric Distribution Free UCLs</b>                                                                                            |         |                                                               |   |       |                                         |   |   |   |   |   |
| 2947 | 95% CLT UCL                                                                                                                            | 27762   | 95% Jackknife UCL                                             |   | 27782 |                                         |   |   |   |   |   |
| 2948 | 95% Standard Bootstrap UCL                                                                                                             | 27774   | 95% Bootstrap-t UCL                                           |   | 27931 |                                         |   |   |   |   |   |

| A    | B | C                                                                                                                                        | D         | E | F                                                   | G                                       | H | I | J | K | L |  |
|------|---|------------------------------------------------------------------------------------------------------------------------------------------|-----------|---|-----------------------------------------------------|-----------------------------------------|---|---|---|---|---|--|
| 2949 |   | 95% Hall's Bootstrap UCL                                                                                                                 | 27893     |   | 95% Percentile Bootstrap UCL                        | 27839                                   |   |   |   |   |   |  |
| 2950 |   | 95% BCA Bootstrap UCL                                                                                                                    | 27839     |   |                                                     |                                         |   |   |   |   |   |  |
| 2951 |   | 90% Chebyshev(Mean, Sd) UCL                                                                                                              | 28698     |   | 95% Chebyshev(Mean, Sd) UCL                         | 29637                                   |   |   |   |   |   |  |
| 2952 |   | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            | 30940     |   | 99% Chebyshev(Mean, Sd) UCL                         | 33500                                   |   |   |   |   |   |  |
| 2953 |   |                                                                                                                                          |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2954 |   | <b>Suggested UCL to Use</b>                                                                                                              |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2955 |   | 95% Student's-t UCL                                                                                                                      | 27782     |   |                                                     |                                         |   |   |   |   |   |  |
| 2956 |   |                                                                                                                                          |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2957 |   | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                           |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2958 |   | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                   |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2959 |   |                                                                                                                                          |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2960 |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2961 |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2962 |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2963 |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2964 |   |                                                                                                                                          |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2965 |   |                                                                                                                                          |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2966 |   | <b>Result (eu9_lead)</b>                                                                                                                 |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2967 |   |                                                                                                                                          |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2968 |   | <b>General Statistics</b>                                                                                                                |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2969 |   | Total Number of Observations                                                                                                             | 54        |   | Number of Distinct Observations                     | 51                                      |   |   |   |   |   |  |
| 2970 |   |                                                                                                                                          |           |   | Number of Missing Observations                      | 0                                       |   |   |   |   |   |  |
| 2971 |   | Minimum                                                                                                                                  | 83.1      |   | Mean                                                | 1843                                    |   |   |   |   |   |  |
| 2972 |   | Maximum                                                                                                                                  | 22400     |   | Median                                              | 1460                                    |   |   |   |   |   |  |
| 2973 |   | SD                                                                                                                                       | 2924      |   | Std. Error of Mean                                  | 397.8                                   |   |   |   |   |   |  |
| 2974 |   | Coefficient of Variation                                                                                                                 | 1.587     |   | Skewness                                            | 6.798                                   |   |   |   |   |   |  |
| 2975 |   |                                                                                                                                          |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2976 |   | <b>Normal GOF Test</b>                                                                                                                   |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2977 |   | Shapiro Wilk Test Statistic                                                                                                              | 0.313     |   | <b>Shapiro Wilk GOF Test</b>                        |                                         |   |   |   |   |   |  |
| 2978 |   | 5% Shapiro Wilk P Value                                                                                                                  | 0         |   | Data Not Normal at 5% Significance Level            |                                         |   |   |   |   |   |  |
| 2979 |   | Lilliefors Test Statistic                                                                                                                | 0.377     |   | <b>Lilliefors GOF Test</b>                          |                                         |   |   |   |   |   |  |
| 2980 |   | 5% Lilliefors Critical Value                                                                                                             | 0.12      |   | Data Not Normal at 5% Significance Level            |                                         |   |   |   |   |   |  |
| 2981 |   | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2982 |   |                                                                                                                                          |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2983 |   | <b>Assuming Normal Distribution</b>                                                                                                      |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2984 |   | <b>95% Normal UCL</b>                                                                                                                    |           |   |                                                     | <b>95% UCLs (Adjusted for Skewness)</b> |   |   |   |   |   |  |
| 2985 |   | 95% Student's-t UCL                                                                                                                      | 2509      |   | 95% Adjusted-CLT UCL (Chen-1995)                    | 2890                                    |   |   |   |   |   |  |
| 2986 |   |                                                                                                                                          |           |   | 95% Modified-t UCL (Johnson-1978)                   | 2570                                    |   |   |   |   |   |  |
| 2987 |   |                                                                                                                                          |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2988 |   | <b>Gamma GOF Test</b>                                                                                                                    |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2989 |   | A-D Test Statistic                                                                                                                       | 4.102     |   | <b>Anderson-Darling Gamma GOF Test</b>              |                                         |   |   |   |   |   |  |
| 2990 |   | 5% A-D Critical Value                                                                                                                    | 0.766     |   | Data Not Gamma Distributed at 5% Significance Level |                                         |   |   |   |   |   |  |
| 2991 |   | K-S Test Statistic                                                                                                                       | 0.237     |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |                                         |   |   |   |   |   |  |
| 2992 |   | 5% K-S Critical Value                                                                                                                    | 0.123     |   | Data Not Gamma Distributed at 5% Significance Level |                                         |   |   |   |   |   |  |
| 2993 |   | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2994 |   |                                                                                                                                          |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2995 |   | <b>Gamma Statistics</b>                                                                                                                  |           |   |                                                     |                                         |   |   |   |   |   |  |
| 2996 |   | k hat (MLE)                                                                                                                              | 1.714     |   | k star (bias corrected MLE)                         | 1.631                                   |   |   |   |   |   |  |
| 2997 |   | Theta hat (MLE)                                                                                                                          | 1075      |   | Theta star (bias corrected MLE)                     | 1130                                    |   |   |   |   |   |  |
| 2998 |   | nu hat (MLE)                                                                                                                             | 185.1     |   | nu star (bias corrected)                            | 176.1                                   |   |   |   |   |   |  |
| 2999 |   | MLE Mean (bias corrected)                                                                                                                | 1843      |   | MLE Sd (bias corrected)                             | 1443                                    |   |   |   |   |   |  |
| 3000 |   |                                                                                                                                          |           |   | Approximate Chi Square Value (0.05)                 | 146.4                                   |   |   |   |   |   |  |
| 3001 |   | Adjusted Level of Significance                                                                                                           | 0.0456    |   | Adjusted Chi Square Value                           | 145.7                                   |   |   |   |   |   |  |
| 3002 |   |                                                                                                                                          |           |   |                                                     |                                         |   |   |   |   |   |  |
| 3003 |   | <b>Assuming Gamma Distribution</b>                                                                                                       |           |   |                                                     |                                         |   |   |   |   |   |  |
| 3004 |   | 95% Approximate Gamma UCL (use when n>=50)                                                                                               | 2216      |   | 95% Adjusted Gamma UCL (use when n<50)              | 2228                                    |   |   |   |   |   |  |
| 3005 |   |                                                                                                                                          |           |   |                                                     |                                         |   |   |   |   |   |  |
| 3006 |   | <b>Lognormal GOF Test</b>                                                                                                                |           |   |                                                     |                                         |   |   |   |   |   |  |
| 3007 |   | Shapiro Wilk Test Statistic                                                                                                              | 0.855     |   | <b>Shapiro Wilk Lognormal GOF Test</b>              |                                         |   |   |   |   |   |  |
| 3008 |   | 5% Shapiro Wilk P Value                                                                                                                  | 7.1248E-7 |   | Data Not Lognormal at 5% Significance Level         |                                         |   |   |   |   |   |  |
| 3009 |   | Lilliefors Test Statistic                                                                                                                | 0.173     |   | <b>Lilliefors Lognormal GOF Test</b>                |                                         |   |   |   |   |   |  |
| 3010 |   | 5% Lilliefors Critical Value                                                                                                             | 0.12      |   | Data Not Lognormal at 5% Significance Level         |                                         |   |   |   |   |   |  |
| 3011 |   | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |           |   |                                                     |                                         |   |   |   |   |   |  |
| 3012 |   |                                                                                                                                          |           |   |                                                     |                                         |   |   |   |   |   |  |
| 3013 |   | <b>Lognormal Statistics</b>                                                                                                              |           |   |                                                     |                                         |   |   |   |   |   |  |
| 3014 |   | Minimum of Logged Data                                                                                                                   | 4.42      |   | Mean of logged Data                                 | 7.2                                     |   |   |   |   |   |  |
| 3015 |   | Maximum of Logged Data                                                                                                                   | 10.02     |   | SD of logged Data                                   | 0.726                                   |   |   |   |   |   |  |

| A    | B                                                                                                                                        | C                                           | D         | E | F | G                                                   | H     | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|-----------|---|---|-----------------------------------------------------|-------|---|---|---|---|
| 3016 |                                                                                                                                          |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3017 | <b>Assuming Lognormal Distribution</b>                                                                                                   |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3018 |                                                                                                                                          | 95% H-UCL                                   | 2139      |   |   | 90% Chebyshev (MVUE) UCL                            | 2299  |   |   |   |   |
| 3019 |                                                                                                                                          | 95% Chebyshev (MVUE) UCL                    | 2556      |   |   | 97.5% Chebyshev (MVUE) UCL                          | 2912  |   |   |   |   |
| 3020 |                                                                                                                                          | 99% Chebyshev (MVUE) UCL                    | 3611      |   |   |                                                     |       |   |   |   |   |
| 3021 |                                                                                                                                          |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3022 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3023 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3024 |                                                                                                                                          |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3025 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3026 |                                                                                                                                          | 95% CLT UCL                                 | 2497      |   |   | 95% Jackknife UCL                                   | 2509  |   |   |   |   |
| 3027 |                                                                                                                                          | 95% Standard Bootstrap UCL                  | 2504      |   |   | 95% Bootstrap-t UCL                                 | 4378  |   |   |   |   |
| 3028 |                                                                                                                                          | 95% Hall's Bootstrap UCL                    | 5205      |   |   | 95% Percentile Bootstrap UCL                        | 2643  |   |   |   |   |
| 3029 |                                                                                                                                          | 95% BCA Bootstrap UCL                       | 3053      |   |   |                                                     |       |   |   |   |   |
| 3030 |                                                                                                                                          | 90% Chebyshev(Mean, Sd) UCL                 | 3036      |   |   | 95% Chebyshev(Mean, Sd) UCL                         | 3577  |   |   |   |   |
| 3031 |                                                                                                                                          | 97.5% Chebyshev(Mean, Sd) UCL               | 4327      |   |   | 99% Chebyshev(Mean, Sd) UCL                         | 5801  |   |   |   |   |
| 3032 |                                                                                                                                          |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3033 | <b>Suggested UCL to Use</b>                                                                                                              |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3034 |                                                                                                                                          | 95% Chebyshev (Mean, Sd) UCL                | 3577      |   |   |                                                     |       |   |   |   |   |
| 3035 |                                                                                                                                          |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3036 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3037 | Recommendations are based upon data size, data distribution, and skewness.                                                               |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3038 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3039 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3040 |                                                                                                                                          |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3041 |                                                                                                                                          |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3042 | <b>Result (eu9_manganese)</b>                                                                                                            |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3043 |                                                                                                                                          |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3044 | <b>General Statistics</b>                                                                                                                |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3045 |                                                                                                                                          | Total Number of Observations                | 54        |   |   | Number of Distinct Observations                     | 51    |   |   |   |   |
| 3046 |                                                                                                                                          |                                             |           |   |   | Number of Missing Observations                      | 0     |   |   |   |   |
| 3047 |                                                                                                                                          | Minimum                                     | 729       |   |   | Mean                                                | 10190 |   |   |   |   |
| 3048 |                                                                                                                                          | Maximum                                     | 31100     |   |   | Median                                              | 8895  |   |   |   |   |
| 3049 |                                                                                                                                          | SD                                          | 5631      |   |   | Std. Error of Mean                                  | 766.3 |   |   |   |   |
| 3050 |                                                                                                                                          | Coefficient of Variation                    | 0.553     |   |   | Skewness                                            | 1.471 |   |   |   |   |
| 3051 |                                                                                                                                          |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3052 | <b>Normal GOF Test</b>                                                                                                                   |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3053 |                                                                                                                                          | Shapiro Wilk Test Statistic                 | 0.889     |   |   | <b>Shapiro Wilk GOF Test</b>                        |       |   |   |   |   |
| 3054 |                                                                                                                                          | 5% Shapiro Wilk P Value                     | 3.2751E-5 |   |   | Data Not Normal at 5% Significance Level            |       |   |   |   |   |
| 3055 |                                                                                                                                          | Lilliefors Test Statistic                   | 0.165     |   |   | <b>Lilliefors GOF Test</b>                          |       |   |   |   |   |
| 3056 |                                                                                                                                          | 5% Lilliefors Critical Value                | 0.12      |   |   | Data Not Normal at 5% Significance Level            |       |   |   |   |   |
| 3057 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3058 |                                                                                                                                          |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3059 | <b>Assuming Normal Distribution</b>                                                                                                      |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3060 |                                                                                                                                          | <b>95% Normal UCL</b>                       |           |   |   | <b>95% UCLs (Adjusted for Skewness)</b>             |       |   |   |   |   |
| 3061 |                                                                                                                                          | 95% Student's-t UCL                         | 11473     |   |   | 95% Adjusted-CLT UCL (Chen-1995)                    | 11614 |   |   |   |   |
| 3062 |                                                                                                                                          |                                             |           |   |   | 95% Modified-t UCL (Johnson-1978)                   | 11499 |   |   |   |   |
| 3063 |                                                                                                                                          |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3064 | <b>Gamma GOF Test</b>                                                                                                                    |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3065 |                                                                                                                                          | A-D Test Statistic                          | 1.308     |   |   | <b>Anderson-Darling Gamma GOF Test</b>              |       |   |   |   |   |
| 3066 |                                                                                                                                          | 5% A-D Critical Value                       | 0.757     |   |   | Data Not Gamma Distributed at 5% Significance Level |       |   |   |   |   |
| 3067 |                                                                                                                                          | K-S Test Statistic                          | 0.162     |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |       |   |   |   |   |
| 3068 |                                                                                                                                          | 5% K-S Critical Value                       | 0.122     |   |   | Data Not Gamma Distributed at 5% Significance Level |       |   |   |   |   |
| 3069 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3070 |                                                                                                                                          |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3071 | <b>Gamma Statistics</b>                                                                                                                  |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3072 |                                                                                                                                          | k hat (MLE)                                 | 3.133     |   |   | k star (bias corrected MLE)                         | 2.971 |   |   |   |   |
| 3073 |                                                                                                                                          | Theta hat (MLE)                             | 3253      |   |   | Theta star (bias corrected MLE)                     | 3430  |   |   |   |   |
| 3074 |                                                                                                                                          | nu hat (MLE)                                | 338.3     |   |   | nu star (bias corrected)                            | 320.9 |   |   |   |   |
| 3075 |                                                                                                                                          | MLE Mean (bias corrected)                   | 10190     |   |   | MLE Sd (bias corrected)                             | 5912  |   |   |   |   |
| 3076 |                                                                                                                                          |                                             |           |   |   | Approximate Chi Square Value (0.05)                 | 280.4 |   |   |   |   |
| 3077 |                                                                                                                                          | Adjusted Level of Significance              | 0.0456    |   |   | Adjusted Chi Square Value                           | 279.3 |   |   |   |   |
| 3078 |                                                                                                                                          |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3079 | <b>Assuming Gamma Distribution</b>                                                                                                       |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3080 |                                                                                                                                          | 95% Approximate Gamma UCL (use when n>=50)) | 11662     |   |   | 95% Adjusted Gamma UCL (use when n<50)              | 11705 |   |   |   |   |
| 3081 |                                                                                                                                          |                                             |           |   |   |                                                     |       |   |   |   |   |
| 3082 | <b>Lognormal GOF Test</b>                                                                                                                |                                             |           |   |   |                                                     |       |   |   |   |   |

|      | A                                                                                                                                        | B | C | D | E | F         | G                                                            | H | I | J | K | L      |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|-----------|--------------------------------------------------------------|---|---|---|---|--------|
| 3083 | Shapiro Wilk Test Statistic                                                                                                              |   |   |   |   | 0.877     | <b>Shapiro Wilk Lognormal GOF Test</b>                       |   |   |   |   |        |
| 3084 | 5% Shapiro Wilk P Value                                                                                                                  |   |   |   |   | 8.8210E-6 | Data Not Lognormal at 5% Significance Level                  |   |   |   |   |        |
| 3085 | Lilliefors Test Statistic                                                                                                                |   |   |   |   | 0.205     | <b>Lilliefors Lognormal GOF Test</b>                         |   |   |   |   |        |
| 3086 | 5% Lilliefors Critical Value                                                                                                             |   |   |   |   | 0.12      | Data Not Lognormal at 5% Significance Level                  |   |   |   |   |        |
| 3087 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3088 |                                                                                                                                          |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3089 | <b>Lognormal Statistics</b>                                                                                                              |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3090 | Minimum of Logged Data                                                                                                                   |   |   |   |   | 6.592     | Mean of logged Data                                          |   |   |   |   | 9.061  |
| 3091 | Maximum of Logged Data                                                                                                                   |   |   |   |   | 10.34     | SD of logged Data                                            |   |   |   |   | 0.659  |
| 3092 |                                                                                                                                          |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3093 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3094 | 95% H-UCL                                                                                                                                |   |   |   |   | 12825     | 90% Chebyshev (MVUE) UCL                                     |   |   |   |   | 13764  |
| 3095 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   |   |   | 15174     | 97.5% Chebyshev (MVUE) UCL                                   |   |   |   |   | 17131  |
| 3096 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   |   |   | 20974     |                                                              |   |   |   |   |        |
| 3097 |                                                                                                                                          |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3098 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3099 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3100 |                                                                                                                                          |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3101 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3102 | 95% CLT UCL                                                                                                                              |   |   |   |   | 11451     | 95% Jackknife UCL                                            |   |   |   |   | 11473  |
| 3103 | 95% Standard Bootstrap UCL                                                                                                               |   |   |   |   | 11442     | 95% Bootstrap-t UCL                                          |   |   |   |   | 11764  |
| 3104 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   |   |   | 11736     | 95% Percentile Bootstrap UCL                                 |   |   |   |   | 11510  |
| 3105 | 95% BCA Bootstrap UCL                                                                                                                    |   |   |   |   | 11571     |                                                              |   |   |   |   |        |
| 3106 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   |   |   | 12489     | 95% Chebyshev(Mean, Sd) UCL                                  |   |   |   |   | 13530  |
| 3107 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   |   |   | 14975     | 99% Chebyshev(Mean, Sd) UCL                                  |   |   |   |   | 17814  |
| 3108 |                                                                                                                                          |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3109 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3110 | 95% Chebyshev (Mean, Sd) UCL                                                                                                             |   |   |   |   | 13530     |                                                              |   |   |   |   |        |
| 3111 |                                                                                                                                          |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3112 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3113 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3114 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3115 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3116 |                                                                                                                                          |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3117 | <b>Result (eu9_thallium)</b>                                                                                                             |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3118 |                                                                                                                                          |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3119 | <b>General Statistics</b>                                                                                                                |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3120 | Total Number of Observations                                                                                                             |   |   |   |   | 52        | Number of Distinct Observations                              |   |   |   |   | 35     |
| 3121 | Number of Detects                                                                                                                        |   |   |   |   | 16        | Number of Non-Detects                                        |   |   |   |   | 36     |
| 3122 | Number of Distinct Detects                                                                                                               |   |   |   |   | 14        | Number of Distinct Non-Detects                               |   |   |   |   | 21     |
| 3123 | Minimum Detect                                                                                                                           |   |   |   |   | 0.18      | Minimum Non-Detect                                           |   |   |   |   | 0.004  |
| 3124 | Maximum Detect                                                                                                                           |   |   |   |   | 171       | Maximum Non-Detect                                           |   |   |   |   | 1      |
| 3125 | Variance Detects                                                                                                                         |   |   |   |   | 1806      | Percent Non-Detects                                          |   |   |   |   | 69.23% |
| 3126 | Mean Detects                                                                                                                             |   |   |   |   | 11.75     | SD Detects                                                   |   |   |   |   | 42.5   |
| 3127 | Median Detects                                                                                                                           |   |   |   |   | 0.295     | CV Detects                                                   |   |   |   |   | 3.618  |
| 3128 | Skewness Detects                                                                                                                         |   |   |   |   | 3.99      | Kurtosis Detects                                             |   |   |   |   | 15.94  |
| 3129 | Mean of Logged Detects                                                                                                                   |   |   |   |   | -0.319    | SD of Logged Detects                                         |   |   |   |   | 1.853  |
| 3130 |                                                                                                                                          |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3131 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3132 | Shapiro Wilk Test Statistic                                                                                                              |   |   |   |   | 0.298     | <b>Shapiro Wilk GOF Test</b>                                 |   |   |   |   |        |
| 3133 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   |   |   | 0.887     | Detected Data Not Normal at 5% Significance Level            |   |   |   |   |        |
| 3134 | Lilliefors Test Statistic                                                                                                                |   |   |   |   | 0.497     | <b>Lilliefors GOF Test</b>                                   |   |   |   |   |        |
| 3135 | 5% Lilliefors Critical Value                                                                                                             |   |   |   |   | 0.213     | Detected Data Not Normal at 5% Significance Level            |   |   |   |   |        |
| 3136 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3137 |                                                                                                                                          |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3138 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3139 | KM Mean                                                                                                                                  |   |   |   |   | 3.663     | KM Standard Error of Mean                                    |   |   |   |   | 3.359  |
| 3140 | KM SD                                                                                                                                    |   |   |   |   | 23.45     | 95% KM (BCA) UCL                                             |   |   |   |   | 10.25  |
| 3141 | 95% KM (t) UCL                                                                                                                           |   |   |   |   | 9.291     | 95% KM (Percentile Bootstrap) UCL                            |   |   |   |   | 10.18  |
| 3142 | 95% KM (z) UCL                                                                                                                           |   |   |   |   | 9.188     | 95% KM Bootstrap t UCL                                       |   |   |   |   | 126.8  |
| 3143 | 90% KM Chebyshev UCL                                                                                                                     |   |   |   |   | 13.74     | 95% KM Chebyshev UCL                                         |   |   |   |   | 18.31  |
| 3144 | 97.5% KM Chebyshev UCL                                                                                                                   |   |   |   |   | 24.64     | 99% KM Chebyshev UCL                                         |   |   |   |   | 37.09  |
| 3145 |                                                                                                                                          |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3146 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |   |   |   |   |           |                                                              |   |   |   |   |        |
| 3147 | A-D Test Statistic                                                                                                                       |   |   |   |   | 3.289     | <b>Anderson-Darling GOF Test</b>                             |   |   |   |   |        |
| 3148 | 5% A-D Critical Value                                                                                                                    |   |   |   |   | 0.859     | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |   |   |        |
| 3149 | K-S Test Statistic                                                                                                                       |   |   |   |   | 0.352     | <b>Kolmogorov-Smirnov GOF</b>                                |   |   |   |   |        |

|      | A                                                                                                                         | B | C | D      | E                                                            | F | G                           | H      | I | J | K | L |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|--------|--------------------------------------------------------------|---|-----------------------------|--------|---|---|---|---|
| 3150 | 5% K-S Critical Value                                                                                                     |   |   | 0.235  | Detected Data Not Gamma Distributed at 5% Significance Level |   |                             |        |   |   |   |   |
| 3151 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                       |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3152 |                                                                                                                           |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3153 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3154 | k hat (MLE)                                                                                                               |   |   | 0.255  | k star (bias corrected MLE)                                  |   |                             | 0.248  |   |   |   |   |
| 3155 | Theta hat (MLE)                                                                                                           |   |   | 46.15  | Theta star (bias corrected MLE)                              |   |                             | 47.28  |   |   |   |   |
| 3156 | nu hat (MLE)                                                                                                              |   |   | 8.146  | nu star (bias corrected)                                     |   |                             | 7.952  |   |   |   |   |
| 3157 | Mean (detects)                                                                                                            |   |   | 11.75  |                                                              |   |                             |        |   |   |   |   |
| 3158 |                                                                                                                           |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3159 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3160 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3161 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3162 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3163 | This is especially true when the sample size is small.                                                                    |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3164 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3165 | Minimum                                                                                                                   |   |   | 0.01   | Mean                                                         |   |                             | 3.622  |   |   |   |   |
| 3166 | Maximum                                                                                                                   |   |   | 171    | Median                                                       |   |                             | 0.01   |   |   |   |   |
| 3167 | SD                                                                                                                        |   |   | 23.69  | CV                                                           |   |                             | 6.541  |   |   |   |   |
| 3168 | k hat (MLE)                                                                                                               |   |   | 0.166  | k star (bias corrected MLE)                                  |   |                             | 0.169  |   |   |   |   |
| 3169 | Theta hat (MLE)                                                                                                           |   |   | 21.87  | Theta star (bias corrected MLE)                              |   |                             | 21.44  |   |   |   |   |
| 3170 | nu hat (MLE)                                                                                                              |   |   | 17.23  | nu star (bias corrected)                                     |   |                             | 17.56  |   |   |   |   |
| 3171 | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   | 0.0454 |                                                              |   |                             |        |   |   |   |   |
| 3172 | Approximate Chi Square Value (17.56, $\alpha$ )                                                                           |   |   | 9.077  | Adjusted Chi Square Value (17.56, $\beta$ )                  |   |                             | 8.903  |   |   |   |   |
| 3173 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   | 7.008  | 95% Gamma Adjusted UCL (use when $n < 50$ )                  |   |                             | 7.145  |   |   |   |   |
| 3174 |                                                                                                                           |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3175 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3176 | Mean (KM)                                                                                                                 |   |   | 3.663  | SD (KM)                                                      |   |                             | 23.45  |   |   |   |   |
| 3177 | Variance (KM)                                                                                                             |   |   | 550.1  | SE of Mean (KM)                                              |   |                             | 3.359  |   |   |   |   |
| 3178 | k hat (KM)                                                                                                                |   |   | 0.0244 | k star (KM)                                                  |   |                             | 0.0358 |   |   |   |   |
| 3179 | nu hat (KM)                                                                                                               |   |   | 2.537  | nu star (KM)                                                 |   |                             | 3.724  |   |   |   |   |
| 3180 | theta hat (KM)                                                                                                            |   |   | 150.2  | theta star (KM)                                              |   |                             | 102.3  |   |   |   |   |
| 3181 | 80% gamma percentile (KM)                                                                                                 |   |   | 0.116  | 90% gamma percentile (KM)                                    |   |                             | 3.214  |   |   |   |   |
| 3182 | 95% gamma percentile (KM)                                                                                                 |   |   | 16.38  | 99% gamma percentile (KM)                                    |   |                             | 89.81  |   |   |   |   |
| 3183 |                                                                                                                           |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3184 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3185 | Approximate Chi Square Value (3.72, $\alpha$ )                                                                            |   |   | 0.616  | Adjusted Chi Square Value (3.72, $\beta$ )                   |   |                             | 0.583  |   |   |   |   |
| 3186 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   |   | 22.15  | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )               |   |                             | 23.4   |   |   |   |   |
| 3187 |                                                                                                                           |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3188 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3189 | Shapiro Wilk Test Statistic                                                                                               |   |   | 0.729  | <b>Shapiro Wilk GOF Test</b>                                 |   |                             |        |   |   |   |   |
| 3190 | 5% Shapiro Wilk Critical Value                                                                                            |   |   | 0.887  | Detected Data Not Lognormal at 5% Significance Level         |   |                             |        |   |   |   |   |
| 3191 | Lilliefors Test Statistic                                                                                                 |   |   | 0.299  | <b>Lilliefors GOF Test</b>                                   |   |                             |        |   |   |   |   |
| 3192 | 5% Lilliefors Critical Value                                                                                              |   |   | 0.213  | Detected Data Not Lognormal at 5% Significance Level         |   |                             |        |   |   |   |   |
| 3193 | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                               |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3194 |                                                                                                                           |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3195 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3196 | Mean in Original Scale                                                                                                    |   |   | 3.644  | Mean in Log Scale                                            |   |                             | -2.733 |   |   |   |   |
| 3197 | SD in Original Scale                                                                                                      |   |   | 23.68  | SD in Log Scale                                              |   |                             | 2.141  |   |   |   |   |
| 3198 | 95% t UCL (assumes normality of ROS data)                                                                                 |   |   | 9.147  | 95% Percentile Bootstrap UCL                                 |   |                             | 10.2   |   |   |   |   |
| 3199 | 95% BCA Bootstrap UCL                                                                                                     |   |   | 13.67  | 95% Bootstrap t UCL                                          |   |                             | 143.1  |   |   |   |   |
| 3200 | 95% H-UCL (Log ROS)                                                                                                       |   |   | 1.994  |                                                              |   |                             |        |   |   |   |   |
| 3201 |                                                                                                                           |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3202 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3203 | KM Mean (logged)                                                                                                          |   |   | -3.206 | KM Geo Mean                                                  |   |                             | 0.0405 |   |   |   |   |
| 3204 | KM SD (logged)                                                                                                            |   |   | 2.638  | 95% Critical H Value (KM-Log)                                |   |                             | 4.506  |   |   |   |   |
| 3205 | KM Standard Error of Mean (logged)                                                                                        |   |   | 0.455  | 95% H-UCL (KM -Log)                                          |   |                             | 6.947  |   |   |   |   |
| 3206 | KM SD (logged)                                                                                                            |   |   | 2.638  | 95% Critical H Value (KM-Log)                                |   |                             | 4.506  |   |   |   |   |
| 3207 | KM Standard Error of Mean (logged)                                                                                        |   |   | 0.455  |                                                              |   |                             |        |   |   |   |   |
| 3208 |                                                                                                                           |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3209 | <b>DL/2 Statistics</b>                                                                                                    |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3210 | <b>DL/2 Normal</b>                                                                                                        |   |   |        |                                                              |   | <b>DL/2 Log-Transformed</b> |        |   |   |   |   |
| 3211 | Mean in Original Scale                                                                                                    |   |   | 3.754  | Mean in Log Scale                                            |   |                             | -1.79  |   |   |   |   |
| 3212 | SD in Original Scale                                                                                                      |   |   | 23.67  | SD in Log Scale                                              |   |                             | 1.979  |   |   |   |   |
| 3213 | 95% t UCL (Assumes normality)                                                                                             |   |   | 9.253  | 95% H-Stat UCL                                               |   |                             | 3.157  |   |   |   |   |
| 3214 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                  |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3215 |                                                                                                                           |   |   |        |                                                              |   |                             |        |   |   |   |   |
| 3216 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                     |   |   |        |                                                              |   |                             |        |   |   |   |   |

|      | A                                                                                                                                        | B | C | D         | E | F                                                               | G                                   | H | I     | J     | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|-----------|---|-----------------------------------------------------------------|-------------------------------------|---|-------|-------|---|---|
| 3217 | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                            |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3218 |                                                                                                                                          |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3219 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3220 | 95% KM (Chebyshev) UCL                                                                                                                   |   |   | 18.31     |   |                                                                 |                                     |   |       |       |   |   |
| 3221 |                                                                                                                                          |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3222 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3223 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3224 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3225 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3226 |                                                                                                                                          |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3227 |                                                                                                                                          |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3228 | <b>Result (eu9_zinc)</b>                                                                                                                 |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3229 |                                                                                                                                          |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3230 | <b>General Statistics</b>                                                                                                                |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3231 | Total Number of Observations                                                                                                             |   |   | 54        |   | Number of Distinct Observations                                 |                                     |   | 48    |       |   |   |
| 3232 |                                                                                                                                          |   |   |           |   |                                                                 | Number of Missing Observations      |   |       | 0     |   |   |
| 3233 | Minimum                                                                                                                                  |   |   | 539       |   | Mean                                                            |                                     |   | 2578  |       |   |   |
| 3234 | Maximum                                                                                                                                  |   |   | 9650      |   | Median                                                          |                                     |   | 2250  |       |   |   |
| 3235 | SD                                                                                                                                       |   |   | 1588      |   | Std. Error of Mean                                              |                                     |   | 216.1 |       |   |   |
| 3236 | Coefficient of Variation                                                                                                                 |   |   | 0.616     |   | Skewness                                                        |                                     |   | 2.106 |       |   |   |
| 3237 |                                                                                                                                          |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3238 | <b>Normal GOF Test</b>                                                                                                                   |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3239 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.841     |   | <b>Shapiro Wilk GOF Test</b>                                    |                                     |   |       |       |   |   |
| 3240 | 5% Shapiro Wilk P Value                                                                                                                  |   |   | 1.4005E-7 |   | Data Not Normal at 5% Significance Level                        |                                     |   |       |       |   |   |
| 3241 | Lilliefors Test Statistic                                                                                                                |   |   | 0.14      |   | <b>Lilliefors GOF Test</b>                                      |                                     |   |       |       |   |   |
| 3242 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.12      |   | Data Not Normal at 5% Significance Level                        |                                     |   |       |       |   |   |
| 3243 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3244 |                                                                                                                                          |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3245 | <b>Assuming Normal Distribution</b>                                                                                                      |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3246 | <b>95% Normal UCL</b>                                                                                                                    |   |   |           |   | <b>95% UCLs (Adjusted for Skewness)</b>                         |                                     |   |       |       |   |   |
| 3247 | 95% Student's-t UCL                                                                                                                      |   |   | 2940      |   | 95% Adjusted-CLT UCL (Chen-1995)                                |                                     |   | 2999  |       |   |   |
| 3248 |                                                                                                                                          |   |   |           |   |                                                                 | 95% Modified-t UCL (Johnson-1978)   |   |       | 2950  |   |   |
| 3249 |                                                                                                                                          |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3250 | <b>Gamma GOF Test</b>                                                                                                                    |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3251 | A-D Test Statistic                                                                                                                       |   |   | 0.413     |   | <b>Anderson-Darling Gamma GOF Test</b>                          |                                     |   |       |       |   |   |
| 3252 | 5% A-D Critical Value                                                                                                                    |   |   | 0.756     |   | Detected data appear Gamma Distributed at 5% Significance Level |                                     |   |       |       |   |   |
| 3253 | K-S Test Statistic                                                                                                                       |   |   | 0.0754    |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |                                     |   |       |       |   |   |
| 3254 | 5% K-S Critical Value                                                                                                                    |   |   | 0.122     |   | Detected data appear Gamma Distributed at 5% Significance Level |                                     |   |       |       |   |   |
| 3255 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3256 |                                                                                                                                          |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3257 | <b>Gamma Statistics</b>                                                                                                                  |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3258 | k hat (MLE)                                                                                                                              |   |   | 3.327     |   | k star (bias corrected MLE)                                     |                                     |   | 3.154 |       |   |   |
| 3259 | Theta hat (MLE)                                                                                                                          |   |   | 774.9     |   | Theta star (bias corrected MLE)                                 |                                     |   | 817.3 |       |   |   |
| 3260 | nu hat (MLE)                                                                                                                             |   |   | 359.3     |   | nu star (bias corrected)                                        |                                     |   | 340.6 |       |   |   |
| 3261 | MLE Mean (bias corrected)                                                                                                                |   |   | 2578      |   | MLE Sd (bias corrected)                                         |                                     |   | 1451  |       |   |   |
| 3262 |                                                                                                                                          |   |   |           |   |                                                                 | Approximate Chi Square Value (0.05) |   |       | 298.9 |   |   |
| 3263 | Adjusted Level of Significance                                                                                                           |   |   | 0.0456    |   | Adjusted Chi Square Value                                       |                                     |   | 297.8 |       |   |   |
| 3264 |                                                                                                                                          |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3265 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3266 | 95% Approximate Gamma UCL (use when n>=50)                                                                                               |   |   | 2938      |   | 95% Adjusted Gamma UCL (use when n<50)                          |                                     |   | 2949  |       |   |   |
| 3267 |                                                                                                                                          |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3268 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3269 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.983     |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |                                     |   |       |       |   |   |
| 3270 | 5% Shapiro Wilk P Value                                                                                                                  |   |   | 0.818     |   | Data appear Lognormal at 5% Significance Level                  |                                     |   |       |       |   |   |
| 3271 | Lilliefors Test Statistic                                                                                                                |   |   | 0.0884    |   | <b>Lilliefors Lognormal GOF Test</b>                            |                                     |   |       |       |   |   |
| 3272 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.12      |   | Data appear Lognormal at 5% Significance Level                  |                                     |   |       |       |   |   |
| 3273 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3274 |                                                                                                                                          |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3275 | <b>Lognormal Statistics</b>                                                                                                              |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3276 | Minimum of Logged Data                                                                                                                   |   |   | 6.29      |   | Mean of logged Data                                             |                                     |   | 7.697 |       |   |   |
| 3277 | Maximum of Logged Data                                                                                                                   |   |   | 9.175     |   | SD of logged Data                                               |                                     |   | 0.572 |       |   |   |
| 3278 |                                                                                                                                          |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3279 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |           |   |                                                                 |                                     |   |       |       |   |   |
| 3280 | 95% H-UCL                                                                                                                                |   |   | 3017      |   | 90% Chebyshev (MVUE) UCL                                        |                                     |   | 3226  |       |   |   |
| 3281 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 3517      |   | 97.5% Chebyshev (MVUE) UCL                                      |                                     |   | 3921  |       |   |   |
| 3282 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 4715      |   |                                                                 |                                     |   |       |       |   |   |
| 3283 |                                                                                                                                          |   |   |           |   |                                                                 |                                     |   |       |       |   |   |

|      | A                                                                                                                                        | B | C | D    | E | F | G                            | H | I | J    | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|------|---|---|------------------------------|---|---|------|---|---|
| 3284 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |      |   |   |                              |   |   |      |   |   |
| 3285 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |      |   |   |                              |   |   |      |   |   |
| 3286 |                                                                                                                                          |   |   |      |   |   |                              |   |   |      |   |   |
| 3287 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |      |   |   |                              |   |   |      |   |   |
| 3288 | 95% CLT UCL                                                                                                                              |   |   | 2933 |   |   | 95% Jackknife UCL            |   |   | 2940 |   |   |
| 3289 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 2927 |   |   | 95% Bootstrap-t UCL          |   |   | 3055 |   |   |
| 3290 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 3067 |   |   | 95% Percentile Bootstrap UCL |   |   | 2953 |   |   |
| 3291 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 3000 |   |   |                              |   |   |      |   |   |
| 3292 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 3226 |   |   | 95% Chebyshev(Mean, Sd) UCL  |   |   | 3520 |   |   |
| 3293 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 3928 |   |   | 99% Chebyshev(Mean, Sd) UCL  |   |   | 4728 |   |   |
| 3294 |                                                                                                                                          |   |   |      |   |   |                              |   |   |      |   |   |
| 3295 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |      |   |   |                              |   |   |      |   |   |
| 3296 | 95% Approximate Gamma UCL                                                                                                                |   |   | 2938 |   |   |                              |   |   |      |   |   |
| 3297 |                                                                                                                                          |   |   |      |   |   |                              |   |   |      |   |   |
| 3298 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |      |   |   |                              |   |   |      |   |   |
| 3299 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |      |   |   |                              |   |   |      |   |   |
| 3300 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |      |   |   |                              |   |   |      |   |   |
| 3301 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |      |   |   |                              |   |   |      |   |   |
| 3302 |                                                                                                                                          |   |   |      |   |   |                              |   |   |      |   |   |

|    | A                                                                                                          | B                             | C     | D | E | F | G                                       | H | I                                                               | J                  | K     | L |  |
|----|------------------------------------------------------------------------------------------------------------|-------------------------------|-------|---|---|---|-----------------------------------------|---|-----------------------------------------------------------------|--------------------|-------|---|--|
| 1  | <b>UCL Statistics for Data Sets with Non-Detects</b>                                                       |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 2  |                                                                                                            |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 3  | User Selected Options                                                                                      |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 4  | Date/Time of Computation                                                                                   | ProUCL 5.12/1/2019 4:39:34 PM |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 5  | From File                                                                                                  | BPMD_HHRA_SWInput_v2.xls      |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 6  | Full Precision                                                                                             | OFF                           |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 7  | Confidence Coefficient                                                                                     | 95%                           |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 8  | Number of Bootstrap Operations                                                                             | 2000                          |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 9  |                                                                                                            |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 10 |                                                                                                            |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 11 | <b>Result (eu6_aluminum)</b>                                                                               |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 12 |                                                                                                            |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 13 | <b>General Statistics</b>                                                                                  |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 14 | Total Number of Observations                                                                               | 7                             |       |   |   |   |                                         |   | Number of Distinct Observations                                 | 7                  |       |   |  |
| 15 |                                                                                                            |                               |       |   |   |   |                                         |   | Number of Missing Observations                                  | 0                  |       |   |  |
| 16 |                                                                                                            | Minimum                       | 75.4  |   |   |   |                                         |   |                                                                 | Mean               | 599.6 |   |  |
| 17 |                                                                                                            | Maximum                       | 1260  |   |   |   |                                         |   |                                                                 | Median             | 548   |   |  |
| 18 |                                                                                                            | SD                            | 381.5 |   |   |   |                                         |   |                                                                 | Std. Error of Mean | 144.2 |   |  |
| 19 |                                                                                                            | Coefficient of Variation      | 0.636 |   |   |   |                                         |   |                                                                 | Skewness           | 0.68  |   |  |
| 20 |                                                                                                            |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 21 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b> |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 22 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>     |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 23 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                        |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 24 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>             |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 25 |                                                                                                            |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 26 | <b>Normal GOF Test</b>                                                                                     |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 27 | Shapiro Wilk Test Statistic                                                                                | 0.942                         |       |   |   |   |                                         |   | <b>Shapiro Wilk GOF Test</b>                                    |                    |       |   |  |
| 28 | 5% Shapiro Wilk Critical Value                                                                             | 0.803                         |       |   |   |   |                                         |   | Data appear Normal at 5% Significance Level                     |                    |       |   |  |
| 29 | Lilliefors Test Statistic                                                                                  | 0.265                         |       |   |   |   |                                         |   | <b>Lilliefors GOF Test</b>                                      |                    |       |   |  |
| 30 | 5% Lilliefors Critical Value                                                                               | 0.304                         |       |   |   |   |                                         |   | Data appear Normal at 5% Significance Level                     |                    |       |   |  |
| 31 | <b>Data appear Normal at 5% Significance Level</b>                                                         |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 32 |                                                                                                            |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 33 | <b>Assuming Normal Distribution</b>                                                                        |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 34 | <b>95% Normal UCL</b>                                                                                      |                               |       |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |                                                                 |                    |       |   |  |
| 35 | 95% Student's-t UCL                                                                                        | 879.9                         |       |   |   |   |                                         |   | 95% Adjusted-CLT UCL (Chen-1995)                                | 876.4              |       |   |  |
| 36 |                                                                                                            |                               |       |   |   |   |                                         |   | 95% Modified-t UCL (Johnson-1978)                               | 886                |       |   |  |
| 37 |                                                                                                            |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 38 | <b>Gamma GOF Test</b>                                                                                      |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 39 | A-D Test Statistic                                                                                         | 0.365                         |       |   |   |   |                                         |   | <b>Anderson-Darling Gamma GOF Test</b>                          |                    |       |   |  |
| 40 | 5% A-D Critical Value                                                                                      | 0.715                         |       |   |   |   |                                         |   | Detected data appear Gamma Distributed at 5% Significance Level |                    |       |   |  |
| 41 | K-S Test Statistic                                                                                         | 0.226                         |       |   |   |   |                                         |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |                    |       |   |  |
| 42 | 5% K-S Critical Value                                                                                      | 0.315                         |       |   |   |   |                                         |   | Detected data appear Gamma Distributed at 5% Significance Level |                    |       |   |  |
| 43 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                     |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 44 |                                                                                                            |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 45 | <b>Gamma Statistics</b>                                                                                    |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 46 | k hat (MLE)                                                                                                | 2.124                         |       |   |   |   |                                         |   | k star (bias corrected MLE)                                     | 1.309              |       |   |  |
| 47 | Theta hat (MLE)                                                                                            | 282.3                         |       |   |   |   |                                         |   | Theta star (bias corrected MLE)                                 | 458.1              |       |   |  |
| 48 | nu hat (MLE)                                                                                               | 29.74                         |       |   |   |   |                                         |   | nu star (bias corrected)                                        | 18.32              |       |   |  |
| 49 | MLE Mean (bias corrected)                                                                                  | 599.6                         |       |   |   |   |                                         |   | MLE Sd (bias corrected)                                         | 524.1              |       |   |  |
| 50 |                                                                                                            |                               |       |   |   |   |                                         |   | Approximate Chi Square Value (0.05)                             | 9.626              |       |   |  |
| 51 | Adjusted Level of Significance                                                                             | 0.0158                        |       |   |   |   |                                         |   | Adjusted Chi Square Value                                       | 7.798              |       |   |  |
| 52 |                                                                                                            |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 53 | <b>Assuming Gamma Distribution</b>                                                                         |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 54 | 95% Approximate Gamma UCL (use when n>=50)                                                                 | 1141                          |       |   |   |   |                                         |   | 95% Adjusted Gamma UCL (use when n<50)                          | 1409               |       |   |  |
| 55 |                                                                                                            |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 56 | <b>Lognormal GOF Test</b>                                                                                  |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 57 | Shapiro Wilk Test Statistic                                                                                | 0.855                         |       |   |   |   |                                         |   | <b>Shapiro Wilk Lognormal GOF Test</b>                          |                    |       |   |  |
| 58 | 5% Shapiro Wilk Critical Value                                                                             | 0.803                         |       |   |   |   |                                         |   | Data appear Lognormal at 5% Significance Level                  |                    |       |   |  |
| 59 | Lilliefors Test Statistic                                                                                  | 0.284                         |       |   |   |   |                                         |   | <b>Lilliefors Lognormal GOF Test</b>                            |                    |       |   |  |
| 60 | 5% Lilliefors Critical Value                                                                               | 0.304                         |       |   |   |   |                                         |   | Data appear Lognormal at 5% Significance Level                  |                    |       |   |  |
| 61 | <b>Data appear Lognormal at 5% Significance Level</b>                                                      |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 62 |                                                                                                            |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 63 | <b>Lognormal Statistics</b>                                                                                |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 64 | Minimum of Logged Data                                                                                     | 4.323                         |       |   |   |   |                                         |   | Mean of logged Data                                             | 6.143              |       |   |  |
| 65 | Maximum of Logged Data                                                                                     | 7.139                         |       |   |   |   |                                         |   | SD of logged Data                                               | 0.898              |       |   |  |
| 66 |                                                                                                            |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |
| 67 | <b>Assuming Lognormal Distribution</b>                                                                     |                               |       |   |   |   |                                         |   |                                                                 |                    |       |   |  |

| A   | B | C | D | E                                                                                                                                              | F     | G | H | I | J                               | K | L     |
|-----|---|---|---|------------------------------------------------------------------------------------------------------------------------------------------------|-------|---|---|---|---------------------------------|---|-------|
| 68  |   |   |   | 95% H-UCL                                                                                                                                      | 2433  |   |   |   | 90% Chebyshev (MVUE) UCL        |   | 1312  |
| 69  |   |   |   | 95% Chebyshev (MVUE) UCL                                                                                                                       | 1613  |   |   |   | 97.5% Chebyshev (MVUE) UCL      |   | 2030  |
| 70  |   |   |   | 99% Chebyshev (MVUE) UCL                                                                                                                       | 2850  |   |   |   |                                 |   |       |
| 71  |   |   |   |                                                                                                                                                |       |   |   |   |                                 |   |       |
| 72  |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                          |       |   |   |   |                                 |   |       |
| 73  |   |   |   | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                               |       |   |   |   |                                 |   |       |
| 74  |   |   |   |                                                                                                                                                |       |   |   |   |                                 |   |       |
| 75  |   |   |   | <b>Nonparametric Distribution Free UCLs</b>                                                                                                    |       |   |   |   |                                 |   |       |
| 76  |   |   |   | 95% CLT UCL                                                                                                                                    | 836.8 |   |   |   | 95% Jackknife UCL               |   | 879.9 |
| 77  |   |   |   | 95% Standard Bootstrap UCL                                                                                                                     | 826.3 |   |   |   | 95% Bootstrap-t UCL             |   | 1046  |
| 78  |   |   |   | 95% Hall's Bootstrap UCL                                                                                                                       | 3305  |   |   |   | 95% Percentile Bootstrap UCL    |   | 830.9 |
| 79  |   |   |   | 95% BCA Bootstrap UCL                                                                                                                          | 833   |   |   |   |                                 |   |       |
| 80  |   |   |   | 90% Chebyshev(Mean, Sd) UCL                                                                                                                    | 1032  |   |   |   | 95% Chebyshev(Mean, Sd) UCL     |   | 1228  |
| 81  |   |   |   | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                                  | 1500  |   |   |   | 99% Chebyshev(Mean, Sd) UCL     |   | 2034  |
| 82  |   |   |   |                                                                                                                                                |       |   |   |   |                                 |   |       |
| 83  |   |   |   | <b>Suggested UCL to Use</b>                                                                                                                    |       |   |   |   |                                 |   |       |
| 84  |   |   |   | 95% Student's-t UCL                                                                                                                            | 879.9 |   |   |   |                                 |   |       |
| 85  |   |   |   |                                                                                                                                                |       |   |   |   |                                 |   |       |
| 86  |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.                   |       |   |   |   |                                 |   |       |
| 87  |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                                     |       |   |   |   |                                 |   |       |
| 88  |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                       |       |   |   |   |                                 |   |       |
| 89  |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician       |       |   |   |   |                                 |   |       |
| 90  |   |   |   |                                                                                                                                                |       |   |   |   |                                 |   |       |
| 91  |   |   |   | <b>Result (eu6_antimony)</b>                                                                                                                   |       |   |   |   |                                 |   |       |
| 92  |   |   |   |                                                                                                                                                |       |   |   |   |                                 |   |       |
| 93  |   |   |   | <b>General Statistics</b>                                                                                                                      |       |   |   |   |                                 |   |       |
| 94  |   |   |   | Total Number of Observations                                                                                                                   | 7     |   |   |   | Number of Distinct Observations |   | 2     |
| 95  |   |   |   | Number of Detects                                                                                                                              | 0     |   |   |   | Number of Non-Detects           |   | 7     |
| 96  |   |   |   | Number of Distinct Detects                                                                                                                     | 0     |   |   |   | Number of Distinct Non-Detects  |   | 2     |
| 97  |   |   |   |                                                                                                                                                |       |   |   |   |                                 |   |       |
| 98  |   |   |   | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                             |       |   |   |   |                                 |   |       |
| 99  |   |   |   | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>                       |       |   |   |   |                                 |   |       |
| 100 |   |   |   | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>              |       |   |   |   |                                 |   |       |
| 101 |   |   |   |                                                                                                                                                |       |   |   |   |                                 |   |       |
| 102 |   |   |   | <b>The data set for variable Result (eu6_antimony) was not processed!</b>                                                                      |       |   |   |   |                                 |   |       |
| 103 |   |   |   |                                                                                                                                                |       |   |   |   |                                 |   |       |
| 104 |   |   |   |                                                                                                                                                |       |   |   |   |                                 |   |       |
| 105 |   |   |   | <b>Result (eu6_arsenic)</b>                                                                                                                    |       |   |   |   |                                 |   |       |
| 106 |   |   |   |                                                                                                                                                |       |   |   |   |                                 |   |       |
| 107 |   |   |   | <b>General Statistics</b>                                                                                                                      |       |   |   |   |                                 |   |       |
| 108 |   |   |   | Total Number of Observations                                                                                                                   | 7     |   |   |   | Number of Distinct Observations |   | 2     |
| 109 |   |   |   | Number of Detects                                                                                                                              | 1     |   |   |   | Number of Non-Detects           |   | 6     |
| 110 |   |   |   | Number of Distinct Detects                                                                                                                     | 1     |   |   |   | Number of Distinct Non-Detects  |   | 1     |
| 111 |   |   |   |                                                                                                                                                |       |   |   |   |                                 |   |       |
| 112 |   |   |   | <b>Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!</b>               |       |   |   |   |                                 |   |       |
| 113 |   |   |   | <b>Suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).</b> |       |   |   |   |                                 |   |       |
| 114 |   |   |   |                                                                                                                                                |       |   |   |   |                                 |   |       |
| 115 |   |   |   | <b>The data set for variable Result (eu6_arsenic) was not processed!</b>                                                                       |       |   |   |   |                                 |   |       |
| 116 |   |   |   |                                                                                                                                                |       |   |   |   |                                 |   |       |
| 117 |   |   |   |                                                                                                                                                |       |   |   |   |                                 |   |       |
| 118 |   |   |   | <b>Result (eu6_beryllium)</b>                                                                                                                  |       |   |   |   |                                 |   |       |
| 119 |   |   |   |                                                                                                                                                |       |   |   |   |                                 |   |       |
| 120 |   |   |   | <b>General Statistics</b>                                                                                                                      |       |   |   |   |                                 |   |       |
| 121 |   |   |   | Total Number of Observations                                                                                                                   | 7     |   |   |   | Number of Distinct Observations |   | 2     |
| 122 |   |   |   | Number of Detects                                                                                                                              | 0     |   |   |   | Number of Non-Detects           |   | 7     |
| 123 |   |   |   | Number of Distinct Detects                                                                                                                     | 0     |   |   |   | Number of Distinct Non-Detects  |   | 2     |
| 124 |   |   |   |                                                                                                                                                |       |   |   |   |                                 |   |       |
| 125 |   |   |   | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                             |       |   |   |   |                                 |   |       |
| 126 |   |   |   | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>                       |       |   |   |   |                                 |   |       |
| 127 |   |   |   | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>              |       |   |   |   |                                 |   |       |
| 128 |   |   |   |                                                                                                                                                |       |   |   |   |                                 |   |       |
| 129 |   |   |   | <b>The data set for variable Result (eu6_beryllium) was not processed!</b>                                                                     |       |   |   |   |                                 |   |       |
| 130 |   |   |   |                                                                                                                                                |       |   |   |   |                                 |   |       |
| 131 |   |   |   |                                                                                                                                                |       |   |   |   |                                 |   |       |
| 132 |   |   |   | <b>Result (eu6_cadmium)</b>                                                                                                                    |       |   |   |   |                                 |   |       |
| 133 |   |   |   |                                                                                                                                                |       |   |   |   |                                 |   |       |
| 134 |   |   |   | <b>General Statistics</b>                                                                                                                      |       |   |   |   |                                 |   |       |

|     | A                                                                                                                                                | B | C | D | E | F      | G                               | H | I | J | K | L      |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|--------|---------------------------------|---|---|---|---|--------|
| 135 | Total Number of Observations                                                                                                                     |   |   |   |   | 7      | Number of Distinct Observations |   |   |   |   | 2      |
| 136 | Number of Detects                                                                                                                                |   |   |   |   | 1      | Number of Non-Detects           |   |   |   |   | 6      |
| 137 | Number of Distinct Detects                                                                                                                       |   |   |   |   | 1      | Number of Distinct Non-Detects  |   |   |   |   | 1      |
| 138 |                                                                                                                                                  |   |   |   |   |        |                                 |   |   |   |   |        |
| 139 | <b>Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!</b>                 |   |   |   |   |        |                                 |   |   |   |   |        |
| 140 | <b>It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, B</b> |   |   |   |   |        |                                 |   |   |   |   |        |
| 141 |                                                                                                                                                  |   |   |   |   |        |                                 |   |   |   |   |        |
| 142 | <b>The data set for variable Result (eu6_cadmium) was not processed!</b>                                                                         |   |   |   |   |        |                                 |   |   |   |   |        |
| 143 |                                                                                                                                                  |   |   |   |   |        |                                 |   |   |   |   |        |
| 144 |                                                                                                                                                  |   |   |   |   |        |                                 |   |   |   |   |        |
| 145 | <b>Result (eu6_chromium)</b>                                                                                                                     |   |   |   |   |        |                                 |   |   |   |   |        |
| 146 |                                                                                                                                                  |   |   |   |   |        |                                 |   |   |   |   |        |
| 147 | <b>General Statistics</b>                                                                                                                        |   |   |   |   |        |                                 |   |   |   |   |        |
| 148 | Total Number of Observations                                                                                                                     |   |   |   |   | 7      | Number of Distinct Observations |   |   |   |   | 2      |
| 149 | Number of Detects                                                                                                                                |   |   |   |   | 0      | Number of Non-Detects           |   |   |   |   | 7      |
| 150 | Number of Distinct Detects                                                                                                                       |   |   |   |   | 0      | Number of Distinct Non-Detects  |   |   |   |   | 2      |
| 151 |                                                                                                                                                  |   |   |   |   |        |                                 |   |   |   |   |        |
| 152 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                               |   |   |   |   |        |                                 |   |   |   |   |        |
| 153 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>                         |   |   |   |   |        |                                 |   |   |   |   |        |
| 154 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>                |   |   |   |   |        |                                 |   |   |   |   |        |
| 155 |                                                                                                                                                  |   |   |   |   |        |                                 |   |   |   |   |        |
| 156 | <b>The data set for variable Result (eu6_chromium) was not processed!</b>                                                                        |   |   |   |   |        |                                 |   |   |   |   |        |
| 157 |                                                                                                                                                  |   |   |   |   |        |                                 |   |   |   |   |        |
| 158 |                                                                                                                                                  |   |   |   |   |        |                                 |   |   |   |   |        |
| 159 |                                                                                                                                                  |   |   |   |   |        |                                 |   |   |   |   |        |
| 160 | <b>Result (eu6_cobalt)</b>                                                                                                                       |   |   |   |   |        |                                 |   |   |   |   |        |
| 161 |                                                                                                                                                  |   |   |   |   |        |                                 |   |   |   |   |        |
| 162 | <b>General Statistics</b>                                                                                                                        |   |   |   |   |        |                                 |   |   |   |   |        |
| 163 | Total Number of Observations                                                                                                                     |   |   |   |   | 1      | Number of Distinct Observations |   |   |   |   | 1      |
| 164 |                                                                                                                                                  |   |   |   |   |        | Number of Missing Observations  |   |   |   |   | 0      |
| 165 | Minimum                                                                                                                                          |   |   |   |   | 0.97   | Mean                            |   |   |   |   | 0.97   |
| 166 | Maximum                                                                                                                                          |   |   |   |   | 0.97   | Median                          |   |   |   |   | 0.97   |
| 167 |                                                                                                                                                  |   |   |   |   |        |                                 |   |   |   |   |        |
| 168 | <b>Warning: This data set only has 1 observations!</b>                                                                                           |   |   |   |   |        |                                 |   |   |   |   |        |
| 169 | <b>Data set is too small to compute reliable and meaningful statistics and estimates!</b>                                                        |   |   |   |   |        |                                 |   |   |   |   |        |
| 170 | <b>The data set for variable Result (eu6_cobalt) was not processed!</b>                                                                          |   |   |   |   |        |                                 |   |   |   |   |        |
| 171 |                                                                                                                                                  |   |   |   |   |        |                                 |   |   |   |   |        |
| 172 | <b>It is suggested to collect at least 8 to 10 observations before using these statistical methods!</b>                                          |   |   |   |   |        |                                 |   |   |   |   |        |
| 173 | <b>If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.</b>                                  |   |   |   |   |        |                                 |   |   |   |   |        |
| 174 |                                                                                                                                                  |   |   |   |   |        |                                 |   |   |   |   |        |
| 175 |                                                                                                                                                  |   |   |   |   |        |                                 |   |   |   |   |        |
| 176 | <b>Result (eu6_copper)</b>                                                                                                                       |   |   |   |   |        |                                 |   |   |   |   |        |
| 177 |                                                                                                                                                  |   |   |   |   |        |                                 |   |   |   |   |        |
| 178 | <b>General Statistics</b>                                                                                                                        |   |   |   |   |        |                                 |   |   |   |   |        |
| 179 | Total Number of Observations                                                                                                                     |   |   |   |   | 7      | Number of Distinct Observations |   |   |   |   | 2      |
| 180 | Number of Detects                                                                                                                                |   |   |   |   | 0      | Number of Non-Detects           |   |   |   |   | 7      |
| 181 | Number of Distinct Detects                                                                                                                       |   |   |   |   | 0      | Number of Distinct Non-Detects  |   |   |   |   | 2      |
| 182 |                                                                                                                                                  |   |   |   |   |        |                                 |   |   |   |   |        |
| 183 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                               |   |   |   |   |        |                                 |   |   |   |   |        |
| 184 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>                         |   |   |   |   |        |                                 |   |   |   |   |        |
| 185 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>                |   |   |   |   |        |                                 |   |   |   |   |        |
| 186 |                                                                                                                                                  |   |   |   |   |        |                                 |   |   |   |   |        |
| 187 | <b>The data set for variable Result (eu6_copper) was not processed!</b>                                                                          |   |   |   |   |        |                                 |   |   |   |   |        |
| 188 |                                                                                                                                                  |   |   |   |   |        |                                 |   |   |   |   |        |
| 189 |                                                                                                                                                  |   |   |   |   |        |                                 |   |   |   |   |        |
| 190 | <b>Result (eu6_iron)</b>                                                                                                                         |   |   |   |   |        |                                 |   |   |   |   |        |
| 191 |                                                                                                                                                  |   |   |   |   |        |                                 |   |   |   |   |        |
| 192 | <b>General Statistics</b>                                                                                                                        |   |   |   |   |        |                                 |   |   |   |   |        |
| 193 | Total Number of Observations                                                                                                                     |   |   |   |   | 7      | Number of Distinct Observations |   |   |   |   | 6      |
| 194 | Number of Detects                                                                                                                                |   |   |   |   | 4      | Number of Non-Detects           |   |   |   |   | 3      |
| 195 | Number of Distinct Detects                                                                                                                       |   |   |   |   | 4      | Number of Distinct Non-Detects  |   |   |   |   | 2      |
| 196 | Minimum Detect                                                                                                                                   |   |   |   |   | 112    | Minimum Non-Detect              |   |   |   |   | 2.1    |
| 197 | Maximum Detect                                                                                                                                   |   |   |   |   | 220    | Maximum Non-Detect              |   |   |   |   | 100    |
| 198 | Variance Detects                                                                                                                                 |   |   |   |   | 2032   | Percent Non-Detects             |   |   |   |   | 42.86% |
| 199 | Mean Detects                                                                                                                                     |   |   |   |   | 173.8  | SD Detects                      |   |   |   |   | 45.08  |
| 200 | Median Detects                                                                                                                                   |   |   |   |   | 181.5  | CV Detects                      |   |   |   |   | 0.259  |
| 201 | Skewness Detects                                                                                                                                 |   |   |   |   | -0.983 | Kurtosis Detects                |   |   |   |   | 1.941  |

| A   | B                                                                                                                         | C | D | E      | F                                                               | G                                                    | H | I     | J | K     | L |  |
|-----|---------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------------------|------------------------------------------------------|---|-------|---|-------|---|--|
| 202 | Mean of Logged Detects                                                                                                    |   |   |        | 5.129                                                           | SD of Logged Detects                                 |   |       |   | 0.288 |   |  |
| 203 |                                                                                                                           |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 204 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 205 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                    |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 206 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                       |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 207 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                            |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 208 |                                                                                                                           |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 209 | <b>Normal GOF Test on Detects Only</b>                                                                                    |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 210 | Shapiro Wilk Test Statistic                                                                                               |   |   |        | 0.932                                                           | <b>Shapiro Wilk GOF Test</b>                         |   |       |   |       |   |  |
| 211 | 5% Shapiro Wilk Critical Value                                                                                            |   |   |        | 0.748                                                           | Detected Data appear Normal at 5% Significance Level |   |       |   |       |   |  |
| 212 | Lilliefors Test Statistic                                                                                                 |   |   |        | 0.288                                                           | <b>Lilliefors GOF Test</b>                           |   |       |   |       |   |  |
| 213 | 5% Lilliefors Critical Value                                                                                              |   |   |        | 0.375                                                           | Detected Data appear Normal at 5% Significance Level |   |       |   |       |   |  |
| 214 | <b>Detected Data appear Normal at 5% Significance Level</b>                                                               |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 215 |                                                                                                                           |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 216 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 217 | KM Mean                                                                                                                   |   |   | 100.2  | KM Standard Error of Mean                                       |                                                      |   | 39.25 |   |       |   |  |
| 218 | KM SD                                                                                                                     |   |   | 89.93  | 95% KM (BCA) UCL                                                |                                                      |   | N/A   |   |       |   |  |
| 219 | 95% KM (t) UCL                                                                                                            |   |   | 176.4  | 95% KM (Percentile Bootstrap) UCL                               |                                                      |   | N/A   |   |       |   |  |
| 220 | 95% KM (z) UCL                                                                                                            |   |   | 164.7  | 95% KM Bootstrap t UCL                                          |                                                      |   | N/A   |   |       |   |  |
| 221 | 90% KM Chebyshev UCL                                                                                                      |   |   | 217.9  | 95% KM Chebyshev UCL                                            |                                                      |   | 271.3 |   |       |   |  |
| 222 | 97.5% KM Chebyshev UCL                                                                                                    |   |   | 345.3  | 99% KM Chebyshev UCL                                            |                                                      |   | 490.7 |   |       |   |  |
| 223 |                                                                                                                           |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 224 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 225 | A-D Test Statistic                                                                                                        |   |   | 0.389  | <b>Anderson-Darling GOF Test</b>                                |                                                      |   |       |   |       |   |  |
| 226 | 5% A-D Critical Value                                                                                                     |   |   | 0.657  | Detected data appear Gamma Distributed at 5% Significance Level |                                                      |   |       |   |       |   |  |
| 227 | K-S Test Statistic                                                                                                        |   |   | 0.322  | <b>Kolmogorov-Smirnov GOF</b>                                   |                                                      |   |       |   |       |   |  |
| 228 | 5% K-S Critical Value                                                                                                     |   |   | 0.394  | Detected data appear Gamma Distributed at 5% Significance Level |                                                      |   |       |   |       |   |  |
| 229 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                    |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 230 |                                                                                                                           |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 231 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 232 | k hat (MLE)                                                                                                               |   |   | 17.38  | k star (bias corrected MLE)                                     |                                                      |   | 4.511 |   |       |   |  |
| 233 | Theta hat (MLE)                                                                                                           |   |   | 9.999  | Theta star (bias corrected MLE)                                 |                                                      |   | 38.52 |   |       |   |  |
| 234 | nu hat (MLE)                                                                                                              |   |   | 139    | nu star (bias corrected)                                        |                                                      |   | 36.09 |   |       |   |  |
| 235 | Mean (detects)                                                                                                            |   |   | 173.8  |                                                                 |                                                      |   |       |   |       |   |  |
| 236 |                                                                                                                           |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 237 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 238 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 239 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 240 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 241 | This is especially true when the sample size is small.                                                                    |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 242 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 243 | Minimum                                                                                                                   |   |   | 43.6   | Mean                                                            |                                                      |   | 125.6 |   |       |   |  |
| 244 | Maximum                                                                                                                   |   |   | 220    | Median                                                          |                                                      |   | 112   |   |       |   |  |
| 245 | SD                                                                                                                        |   |   | 68.72  | CV                                                              |                                                      |   | 0.547 |   |       |   |  |
| 246 | k hat (MLE)                                                                                                               |   |   | 3.493  | k star (bias corrected MLE)                                     |                                                      |   | 2.091 |   |       |   |  |
| 247 | Theta hat (MLE)                                                                                                           |   |   | 35.96  | Theta star (bias corrected MLE)                                 |                                                      |   | 60.07 |   |       |   |  |
| 248 | nu hat (MLE)                                                                                                              |   |   | 48.9   | nu star (bias corrected)                                        |                                                      |   | 29.28 |   |       |   |  |
| 249 | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   | 0.0158 |                                                                 |                                                      |   |       |   |       |   |  |
| 250 | Approximate Chi Square Value (29.28, $\alpha$ )                                                                           |   |   | 17.93  | Adjusted Chi Square Value (29.28, $\beta$ )                     |                                                      |   | 15.31 |   |       |   |  |
| 251 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   | 205.2  | 95% Gamma Adjusted UCL (use when $n < 50$ )                     |                                                      |   | N/A   |   |       |   |  |
| 252 |                                                                                                                           |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 253 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 254 | Mean (KM)                                                                                                                 |   |   | 100.2  | SD (KM)                                                         |                                                      |   | 89.93 |   |       |   |  |
| 255 | Variance (KM)                                                                                                             |   |   | 8087   | SE of Mean (KM)                                                 |                                                      |   | 39.25 |   |       |   |  |
| 256 | k hat (KM)                                                                                                                |   |   | 1.241  | k star (KM)                                                     |                                                      |   | 0.805 |   |       |   |  |
| 257 | nu hat (KM)                                                                                                               |   |   | 17.38  | nu star (KM)                                                    |                                                      |   | 11.26 |   |       |   |  |
| 258 | theta hat (KM)                                                                                                            |   |   | 80.72  | theta star (KM)                                                 |                                                      |   | 124.5 |   |       |   |  |
| 259 | 80% gamma percentile (KM)                                                                                                 |   |   | 163.7  | 90% gamma percentile (KM)                                       |                                                      |   | 243.3 |   |       |   |  |
| 260 | 95% gamma percentile (KM)                                                                                                 |   |   | 324.3  | 99% gamma percentile (KM)                                       |                                                      |   | 515.7 |   |       |   |  |
| 261 |                                                                                                                           |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 262 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 263 | Approximate Chi Square Value (11.26, $\alpha$ )                                                                           |   |   | 4.746  | Adjusted Chi Square Value (11.26, $\beta$ )                     |                                                      |   | 3.554 |   |       |   |  |
| 264 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   |   | 237.8  | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )                  |                                                      |   | 317.5 |   |       |   |  |
| 265 |                                                                                                                           |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 266 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |        |                                                                 |                                                      |   |       |   |       |   |  |
| 267 | Shapiro Wilk Test Statistic                                                                                               |   |   | 0.886  | <b>Shapiro Wilk GOF Test</b>                                    |                                                      |   |       |   |       |   |  |
| 268 | 5% Shapiro Wilk Critical Value                                                                                            |   |   | 0.748  | Detected Data appear Lognormal at 5% Significance Level         |                                                      |   |       |   |       |   |  |

| A   | B                                                                                                                                        | C | D                                         | E | F     | G                                                       | H | I                                 | J | K | L      |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------------------------------|---|-------|---------------------------------------------------------|---|-----------------------------------|---|---|--------|
| 269 |                                                                                                                                          |   | Lilliefors Test Statistic                 |   | 0.323 | <b>Lilliefors GOF Test</b>                              |   |                                   |   |   |        |
| 270 |                                                                                                                                          |   | 5% Lilliefors Critical Value              |   | 0.375 | Detected Data appear Lognormal at 5% Significance Level |   |                                   |   |   |        |
| 271 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                           |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 272 |                                                                                                                                          |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 273 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 274 |                                                                                                                                          |   | Mean in Original Scale                    |   | 132.6 |                                                         |   | Mean in Log Scale                 |   |   | 4.794  |
| 275 |                                                                                                                                          |   | SD in Original Scale                      |   | 60.69 |                                                         |   | SD in Log Scale                   |   |   | 0.471  |
| 276 |                                                                                                                                          |   | 95% t UCL (assumes normality of ROS data) |   | 177.2 |                                                         |   | 95% Percentile Bootstrap UCL      |   |   | 167.4  |
| 277 |                                                                                                                                          |   | 95% BCA Bootstrap UCL                     |   | 171.7 |                                                         |   | 95% Bootstrap t UCL               |   |   | 183.6  |
| 278 |                                                                                                                                          |   | 95% H-UCL (Log ROS)                       |   | 214.2 |                                                         |   |                                   |   |   |        |
| 279 |                                                                                                                                          |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 280 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 281 |                                                                                                                                          |   | KM Mean (logged)                          |   | 3.249 |                                                         |   | KM Geo Mean                       |   |   | 25.75  |
| 282 |                                                                                                                                          |   | KM SD (logged)                            |   | 2.179 |                                                         |   | 95% Critical H Value (KM-Log)     |   |   | 7.314  |
| 283 |                                                                                                                                          |   | KM Standard Error of Mean (logged)        |   | 0.951 |                                                         |   | 95% H-UCL (KM -Log)               |   |   | 185210 |
| 284 |                                                                                                                                          |   | KM SD (logged)                            |   | 2.179 |                                                         |   | 95% Critical H Value (KM-Log)     |   |   | 7.314  |
| 285 |                                                                                                                                          |   | KM Standard Error of Mean (logged)        |   | 0.951 |                                                         |   |                                   |   |   |        |
| 286 |                                                                                                                                          |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 287 | <b>DL/2 Statistics</b>                                                                                                                   |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 288 | <b>DL/2 Normal</b>                                                                                                                       |   |                                           |   |       | <b>DL/2 Log-Transformed</b>                             |   |                                   |   |   |        |
| 289 |                                                                                                                                          |   | Mean in Original Scale                    |   | 113.7 |                                                         |   | Mean in Log Scale                 |   |   | 4.055  |
| 290 |                                                                                                                                          |   | SD in Original Scale                      |   | 82.99 |                                                         |   | SD in Log Scale                   |   |   | 1.869  |
| 291 |                                                                                                                                          |   | 95% t UCL (Assumes normality)             |   | 174.7 |                                                         |   | 95% H-Stat UCL                    |   |   | 41425  |
| 292 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 293 |                                                                                                                                          |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 294 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 295 | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                  |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 296 |                                                                                                                                          |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 297 | <b>Suggested UCL to Use</b>                                                                                                              |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 298 |                                                                                                                                          |   | 95% KM (t) UCL                            |   | 176.4 |                                                         |   |                                   |   |   |        |
| 299 |                                                                                                                                          |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 300 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 301 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 302 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 303 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 304 |                                                                                                                                          |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 305 | <b>Result (eu6_lead)</b>                                                                                                                 |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 306 |                                                                                                                                          |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 307 | <b>General Statistics</b>                                                                                                                |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 308 |                                                                                                                                          |   | Total Number of Observations              |   | 7     |                                                         |   | Number of Distinct Observations   |   |   | 6      |
| 309 |                                                                                                                                          |   | Number of Detects                         |   | 4     |                                                         |   | Number of Non-Detects             |   |   | 3      |
| 310 |                                                                                                                                          |   | Number of Distinct Detects                |   | 4     |                                                         |   | Number of Distinct Non-Detects    |   |   | 2      |
| 311 |                                                                                                                                          |   | Minimum Detect                            |   | 1.01  |                                                         |   | Minimum Non-Detect                |   |   | 0.03   |
| 312 |                                                                                                                                          |   | Maximum Detect                            |   | 10.1  |                                                         |   | Maximum Non-Detect                |   |   | 0.5    |
| 313 |                                                                                                                                          |   | Variance Detects                          |   | 17.83 |                                                         |   | Percent Non-Detects               |   |   | 42.86% |
| 314 |                                                                                                                                          |   | Mean Detects                              |   | 3.87  |                                                         |   | SD Detects                        |   |   | 4.222  |
| 315 |                                                                                                                                          |   | Median Detects                            |   | 2.185 |                                                         |   | CV Detects                        |   |   | 1.091  |
| 316 |                                                                                                                                          |   | Skewness Detects                          |   | 1.814 |                                                         |   | Kurtosis Detects                  |   |   | 3.321  |
| 317 |                                                                                                                                          |   | Mean of Logged Detects                    |   | 0.949 |                                                         |   | SD of Logged Detects              |   |   | 1.002  |
| 318 |                                                                                                                                          |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 319 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                               |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 320 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                   |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 321 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                      |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 322 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                           |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 323 |                                                                                                                                          |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 324 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 325 |                                                                                                                                          |   | Shapiro Wilk Test Statistic               |   | 0.78  | <b>Shapiro Wilk GOF Test</b>                            |   |                                   |   |   |        |
| 326 |                                                                                                                                          |   | 5% Shapiro Wilk Critical Value            |   | 0.748 | Detected Data appear Normal at 5% Significance Level    |   |                                   |   |   |        |
| 327 |                                                                                                                                          |   | Lilliefors Test Statistic                 |   | 0.348 | <b>Lilliefors GOF Test</b>                              |   |                                   |   |   |        |
| 328 |                                                                                                                                          |   | 5% Lilliefors Critical Value              |   | 0.375 | Detected Data appear Normal at 5% Significance Level    |   |                                   |   |   |        |
| 329 | <b>Detected Data appear Normal at 5% Significance Level</b>                                                                              |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 330 |                                                                                                                                          |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 331 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |                                           |   |       |                                                         |   |                                   |   |   |        |
| 332 |                                                                                                                                          |   | KM Mean                                   |   | 2.224 |                                                         |   | KM Standard Error of Mean         |   |   | 1.464  |
| 333 |                                                                                                                                          |   | KM SD                                     |   | 3.354 |                                                         |   | 95% KM (BCA) UCL                  |   |   | N/A    |
| 334 |                                                                                                                                          |   | 95% KM (t) UCL                            |   | 5.069 |                                                         |   | 95% KM (Percentile Bootstrap) UCL |   |   | N/A    |
| 335 |                                                                                                                                          |   | 95% KM (z) UCL                            |   | 4.632 |                                                         |   | 95% KM Bootstrap t UCL            |   |   | N/A    |

| A   | B | C                                                                                                                         | D      | E | F                                                               | G      | H | I | J | K | L |
|-----|---|---------------------------------------------------------------------------------------------------------------------------|--------|---|-----------------------------------------------------------------|--------|---|---|---|---|---|
| 336 |   | 90% KM Chebyshev UCL                                                                                                      | 6.616  |   | 95% KM Chebyshev UCL                                            | 8.605  |   |   |   |   |   |
| 337 |   | 97.5% KM Chebyshev UCL                                                                                                    | 11.37  |   | 99% KM Chebyshev UCL                                            | 16.79  |   |   |   |   |   |
| 338 |   |                                                                                                                           |        |   |                                                                 |        |   |   |   |   |   |
| 339 |   | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |        |   |                                                                 |        |   |   |   |   |   |
| 340 |   | A-D Test Statistic                                                                                                        | 0.385  |   | <b>Anderson-Darling GOF Test</b>                                |        |   |   |   |   |   |
| 341 |   | 5% A-D Critical Value                                                                                                     | 0.663  |   | Detected data appear Gamma Distributed at 5% Significance Level |        |   |   |   |   |   |
| 342 |   | K-S Test Statistic                                                                                                        | 0.274  |   | <b>Kolmogorov-Smirnov GOF</b>                                   |        |   |   |   |   |   |
| 343 |   | 5% K-S Critical Value                                                                                                     | 0.4    |   | Detected data appear Gamma Distributed at 5% Significance Level |        |   |   |   |   |   |
| 344 |   | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                    |        |   |                                                                 |        |   |   |   |   |   |
| 345 |   |                                                                                                                           |        |   |                                                                 |        |   |   |   |   |   |
| 346 |   | <b>Gamma Statistics on Detected Data Only</b>                                                                             |        |   |                                                                 |        |   |   |   |   |   |
| 347 |   | k hat (MLE)                                                                                                               | 1.381  |   | k star (bias corrected MLE)                                     | 0.512  |   |   |   |   |   |
| 348 |   | Theta hat (MLE)                                                                                                           | 2.803  |   | Theta star (bias corrected MLE)                                 | 7.56   |   |   |   |   |   |
| 349 |   | nu hat (MLE)                                                                                                              | 11.05  |   | nu star (bias corrected)                                        | 4.095  |   |   |   |   |   |
| 350 |   | Mean (detects)                                                                                                            | 3.87   |   |                                                                 |        |   |   |   |   |   |
| 351 |   |                                                                                                                           |        |   |                                                                 |        |   |   |   |   |   |
| 352 |   | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |        |   |                                                                 |        |   |   |   |   |   |
| 353 |   | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |        |   |                                                                 |        |   |   |   |   |   |
| 354 |   | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |        |   |                                                                 |        |   |   |   |   |   |
| 355 |   | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |        |   |                                                                 |        |   |   |   |   |   |
| 356 |   | This is especially true when the sample size is small.                                                                    |        |   |                                                                 |        |   |   |   |   |   |
| 357 |   | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |        |   |                                                                 |        |   |   |   |   |   |
| 358 |   | Minimum                                                                                                                   | 0.01   |   | Mean                                                            | 2.216  |   |   |   |   |   |
| 359 |   | Maximum                                                                                                                   | 10.1   |   | Median                                                          | 1.01   |   |   |   |   |   |
| 360 |   | SD                                                                                                                        | 3.629  |   | CV                                                              | 1.638  |   |   |   |   |   |
| 361 |   | k hat (MLE)                                                                                                               | 0.308  |   | k star (bias corrected MLE)                                     | 0.271  |   |   |   |   |   |
| 362 |   | Theta hat (MLE)                                                                                                           | 7.187  |   | Theta star (bias corrected MLE)                                 | 8.164  |   |   |   |   |   |
| 363 |   | nu hat (MLE)                                                                                                              | 4.316  |   | nu star (bias corrected)                                        | 3.8    |   |   |   |   |   |
| 364 |   | Adjusted Level of Significance ( $\beta$ )                                                                                | 0.0158 |   |                                                                 |        |   |   |   |   |   |
| 365 |   | Approximate Chi Square Value (3.80, $\alpha$ )                                                                            | 0.644  |   | Adjusted Chi Square Value (3.80, $\beta$ )                      | 0.35   |   |   |   |   |   |
| 366 |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         | 13.07  |   | 95% Gamma Adjusted UCL (use when $n < 50$ )                     | N/A    |   |   |   |   |   |
| 367 |   |                                                                                                                           |        |   |                                                                 |        |   |   |   |   |   |
| 368 |   | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |        |   |                                                                 |        |   |   |   |   |   |
| 369 |   | Mean (KM)                                                                                                                 | 2.224  |   | SD (KM)                                                         | 3.354  |   |   |   |   |   |
| 370 |   | Variance (KM)                                                                                                             | 11.25  |   | SE of Mean (KM)                                                 | 1.464  |   |   |   |   |   |
| 371 |   | k hat (KM)                                                                                                                | 0.44   |   | k star (KM)                                                     | 0.347  |   |   |   |   |   |
| 372 |   | nu hat (KM)                                                                                                               | 6.156  |   | nu star (KM)                                                    | 4.851  |   |   |   |   |   |
| 373 |   | theta hat (KM)                                                                                                            | 5.058  |   | theta star (KM)                                                 | 6.419  |   |   |   |   |   |
| 374 |   | 80% gamma percentile (KM)                                                                                                 | 3.516  |   | 90% gamma percentile (KM)                                       | 6.433  |   |   |   |   |   |
| 375 |   | 95% gamma percentile (KM)                                                                                                 | 9.705  |   | 99% gamma percentile (KM)                                       | 18.06  |   |   |   |   |   |
| 376 |   |                                                                                                                           |        |   |                                                                 |        |   |   |   |   |   |
| 377 |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |        |   |                                                                 |        |   |   |   |   |   |
| 378 |   | Approximate Chi Square Value (4.85, $\alpha$ )                                                                            | 1.084  |   | Adjusted Chi Square Value (4.85, $\beta$ )                      | 0.643  |   |   |   |   |   |
| 379 |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       | 9.954  |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )                  | 16.78  |   |   |   |   |   |
| 380 |   |                                                                                                                           |        |   |                                                                 |        |   |   |   |   |   |
| 381 |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |        |   |                                                                 |        |   |   |   |   |   |
| 382 |   | Shapiro Wilk Test Statistic                                                                                               | 0.941  |   | <b>Shapiro Wilk GOF Test</b>                                    |        |   |   |   |   |   |
| 383 |   | 5% Shapiro Wilk Critical Value                                                                                            | 0.748  |   | Detected Data appear Lognormal at 5% Significance Level         |        |   |   |   |   |   |
| 384 |   | Lilliefors Test Statistic                                                                                                 | 0.215  |   | <b>Lilliefors GOF Test</b>                                      |        |   |   |   |   |   |
| 385 |   | 5% Lilliefors Critical Value                                                                                              | 0.375  |   | Detected Data appear Lognormal at 5% Significance Level         |        |   |   |   |   |   |
| 386 |   | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                            |        |   |                                                                 |        |   |   |   |   |   |
| 387 |   |                                                                                                                           |        |   |                                                                 |        |   |   |   |   |   |
| 388 |   | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |        |   |                                                                 |        |   |   |   |   |   |
| 389 |   | Mean in Original Scale                                                                                                    | 2.272  |   | Mean in Log Scale                                               | -0.333 |   |   |   |   |   |
| 390 |   | SD in Original Scale                                                                                                      | 3.59   |   | SD in Log Scale                                                 | 1.776  |   |   |   |   |   |
| 391 |   | 95% t UCL (assumes normality of ROS data)                                                                                 | 4.909  |   | 95% Percentile Bootstrap UCL                                    | 4.812  |   |   |   |   |   |
| 392 |   | 95% BCA Bootstrap UCL                                                                                                     | 5.821  |   | 95% Bootstrap t UCL                                             | 12.33  |   |   |   |   |   |
| 393 |   | 95% H-UCL (Log ROS)                                                                                                       | 276.4  |   |                                                                 |        |   |   |   |   |   |
| 394 |   |                                                                                                                           |        |   |                                                                 |        |   |   |   |   |   |
| 395 |   | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |        |   |                                                                 |        |   |   |   |   |   |
| 396 |   | KM Mean (logged)                                                                                                          | -0.96  |   | KM Geo Mean                                                     | 0.383  |   |   |   |   |   |
| 397 |   | KM SD (logged)                                                                                                            | 2.301  |   | 95% Critical H Value (KM-Log)                                   | 7.701  |   |   |   |   |   |
| 398 |   | KM Standard Error of Mean (logged)                                                                                        | 1.004  |   | 95% H-UCL (KM -Log)                                             | 7470   |   |   |   |   |   |
| 399 |   | KM SD (logged)                                                                                                            | 2.301  |   | 95% Critical H Value (KM-Log)                                   | 7.701  |   |   |   |   |   |
| 400 |   | KM Standard Error of Mean (logged)                                                                                        | 1.004  |   |                                                                 |        |   |   |   |   |   |
| 401 |   |                                                                                                                           |        |   |                                                                 |        |   |   |   |   |   |
| 402 |   | <b>DL/2 Statistics</b>                                                                                                    |        |   |                                                                 |        |   |   |   |   |   |

| A   | B                                                                                                                                      | C | D | E | F      | G                                                             | H | I | J | K      | L |
|-----|----------------------------------------------------------------------------------------------------------------------------------------|---|---|---|--------|---------------------------------------------------------------|---|---|---|--------|---|
| 403 | <b>DL/2 Normal</b>                                                                                                                     |   |   |   |        | <b>DL/2 Log-Transformed</b>                                   |   |   |   |        |   |
| 404 | Mean in Original Scale                                                                                                                 |   |   |   | 2.285  | Mean in Log Scale                                             |   |   |   | -0.454 |   |
| 405 | SD in Original Scale                                                                                                                   |   |   |   | 3.581  | SD in Log Scale                                               |   |   |   | 2.108  |   |
| 406 | 95% t UCL (Assumes normality)                                                                                                          |   |   |   | 4.915  | 95% H-Stat UCL                                                |   |   |   | 2610   |   |
| 407 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                               |   |   |   |        |                                                               |   |   |   |        |   |
| 408 |                                                                                                                                        |   |   |   |        |                                                               |   |   |   |        |   |
| 409 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                  |   |   |   |        |                                                               |   |   |   |        |   |
| 410 | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                |   |   |   |        |                                                               |   |   |   |        |   |
| 411 |                                                                                                                                        |   |   |   |        |                                                               |   |   |   |        |   |
| 412 | <b>Suggested UCL to Use</b>                                                                                                            |   |   |   |        |                                                               |   |   |   |        |   |
| 413 | 95% KM (t) UCL                                                                                                                         |   |   |   | 5.069  |                                                               |   |   |   |        |   |
| 414 |                                                                                                                                        |   |   |   |        |                                                               |   |   |   |        |   |
| 415 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.           |   |   |   |        |                                                               |   |   |   |        |   |
| 416 | Recommendations are based upon data size, data distribution, and skewness.                                                             |   |   |   |        |                                                               |   |   |   |        |   |
| 417 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).               |   |   |   |        |                                                               |   |   |   |        |   |
| 418 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistica |   |   |   |        |                                                               |   |   |   |        |   |
| 419 |                                                                                                                                        |   |   |   |        |                                                               |   |   |   |        |   |
| 420 |                                                                                                                                        |   |   |   |        |                                                               |   |   |   |        |   |
| 421 | <b>Result (eu6_manganese)</b>                                                                                                          |   |   |   |        |                                                               |   |   |   |        |   |
| 422 |                                                                                                                                        |   |   |   |        |                                                               |   |   |   |        |   |
| 423 | <b>General Statistics</b>                                                                                                              |   |   |   |        |                                                               |   |   |   |        |   |
| 424 | Total Number of Observations                                                                                                           |   |   |   | 7      | Number of Distinct Observations                               |   |   |   | 7      |   |
| 425 |                                                                                                                                        |   |   |   |        | Number of Missing Observations                                |   |   |   | 0      |   |
| 426 | Minimum                                                                                                                                |   |   |   | 55.3   | Mean                                                          |   |   |   | 104.7  |   |
| 427 | Maximum                                                                                                                                |   |   |   | 172    | Median                                                        |   |   |   | 100    |   |
| 428 | SD                                                                                                                                     |   |   |   | 44.64  | Std. Error of Mean                                            |   |   |   | 16.87  |   |
| 429 | Coefficient of Variation                                                                                                               |   |   |   | 0.426  | Skewness                                                      |   |   |   | 0.381  |   |
| 430 |                                                                                                                                        |   |   |   |        |                                                               |   |   |   |        |   |
| 431 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                             |   |   |   |        |                                                               |   |   |   |        |   |
| 432 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                 |   |   |   |        |                                                               |   |   |   |        |   |
| 433 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                    |   |   |   |        |                                                               |   |   |   |        |   |
| 434 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                         |   |   |   |        |                                                               |   |   |   |        |   |
| 435 |                                                                                                                                        |   |   |   |        |                                                               |   |   |   |        |   |
| 436 | <b>Normal GOF Test</b>                                                                                                                 |   |   |   |        |                                                               |   |   |   |        |   |
| 437 | Shapiro Wilk Test Statistic                                                                                                            |   |   |   | 0.927  | <b>Shapiro Wilk GOF Test</b>                                  |   |   |   |        |   |
| 438 | 5% Shapiro Wilk Critical Value                                                                                                         |   |   |   | 0.803  | Data appear Normal at 5% Significance Level                   |   |   |   |        |   |
| 439 | Lilliefors Test Statistic                                                                                                              |   |   |   | 0.206  | <b>Lilliefors GOF Test</b>                                    |   |   |   |        |   |
| 440 | 5% Lilliefors Critical Value                                                                                                           |   |   |   | 0.304  | Data appear Normal at 5% Significance Level                   |   |   |   |        |   |
| 441 | <b>Data appear Normal at 5% Significance Level</b>                                                                                     |   |   |   |        |                                                               |   |   |   |        |   |
| 442 |                                                                                                                                        |   |   |   |        |                                                               |   |   |   |        |   |
| 443 | <b>Assuming Normal Distribution</b>                                                                                                    |   |   |   |        |                                                               |   |   |   |        |   |
| 444 | <b>95% Normal UCL</b>                                                                                                                  |   |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b>                       |   |   |   |        |   |
| 445 | 95% Student's-t UCL                                                                                                                    |   |   |   | 137.5  | 95% Adjusted-CLT UCL (Chen-1995)                              |   |   |   | 135.1  |   |
| 446 |                                                                                                                                        |   |   |   |        | 95% Modified-t UCL (Johnson-1978)                             |   |   |   | 137.9  |   |
| 447 |                                                                                                                                        |   |   |   |        |                                                               |   |   |   |        |   |
| 448 | <b>Gamma GOF Test</b>                                                                                                                  |   |   |   |        |                                                               |   |   |   |        |   |
| 449 | A-D Test Statistic                                                                                                                     |   |   |   | 0.308  | <b>Anderson-Darling Gamma GOF Test</b>                        |   |   |   |        |   |
| 450 | 5% A-D Critical Value                                                                                                                  |   |   |   | 0.709  | Detected data appear Gamma Distributed at 5% Significance Lev |   |   |   |        |   |
| 451 | K-S Test Statistic                                                                                                                     |   |   |   | 0.214  | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                      |   |   |   |        |   |
| 452 | 5% K-S Critical Value                                                                                                                  |   |   |   | 0.313  | Detected data appear Gamma Distributed at 5% Significance Lev |   |   |   |        |   |
| 453 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                 |   |   |   |        |                                                               |   |   |   |        |   |
| 454 |                                                                                                                                        |   |   |   |        |                                                               |   |   |   |        |   |
| 455 | <b>Gamma Statistics</b>                                                                                                                |   |   |   |        |                                                               |   |   |   |        |   |
| 456 | k hat (MLE)                                                                                                                            |   |   |   | 6.318  | k star (bias corrected MLE)                                   |   |   |   | 3.706  |   |
| 457 | Theta hat (MLE)                                                                                                                        |   |   |   | 16.58  | Theta star (bias corrected MLE)                               |   |   |   | 28.27  |   |
| 458 | nu hat (MLE)                                                                                                                           |   |   |   | 88.46  | nu star (bias corrected)                                      |   |   |   | 51.88  |   |
| 459 | MLE Mean (bias corrected)                                                                                                              |   |   |   | 104.7  | MLE Sd (bias corrected)                                       |   |   |   | 54.41  |   |
| 460 |                                                                                                                                        |   |   |   |        | Approximate Chi Square Value (0.05)                           |   |   |   | 36.34  |   |
| 461 | Adjusted Level of Significance                                                                                                         |   |   |   | 0.0158 | Adjusted Chi Square Value                                     |   |   |   | 32.45  |   |
| 462 |                                                                                                                                        |   |   |   |        |                                                               |   |   |   |        |   |
| 463 | <b>Assuming Gamma Distribution</b>                                                                                                     |   |   |   |        |                                                               |   |   |   |        |   |
| 464 | 95% Approximate Gamma UCL (use when n>=50))                                                                                            |   |   |   | 149.5  | 95% Adjusted Gamma UCL (use when n<50)                        |   |   |   | 167.4  |   |
| 465 |                                                                                                                                        |   |   |   |        |                                                               |   |   |   |        |   |
| 466 | <b>Lognormal GOF Test</b>                                                                                                              |   |   |   |        |                                                               |   |   |   |        |   |
| 467 | Shapiro Wilk Test Statistic                                                                                                            |   |   |   | 0.932  | <b>Shapiro Wilk Lognormal GOF Test</b>                        |   |   |   |        |   |
| 468 | 5% Shapiro Wilk Critical Value                                                                                                         |   |   |   | 0.803  | Data appear Lognormal at 5% Significance Level                |   |   |   |        |   |
| 469 | Lilliefors Test Statistic                                                                                                              |   |   |   | 0.189  | <b>Lilliefors Lognormal GOF Test</b>                          |   |   |   |        |   |

| A   | B | C                                                                                                                                      | D     | E | F | G                                                             | H     | I | J | K | L |
|-----|---|----------------------------------------------------------------------------------------------------------------------------------------|-------|---|---|---------------------------------------------------------------|-------|---|---|---|---|
| 470 |   | 5% Lilliefors Critical Value                                                                                                           | 0.304 |   |   | Data appear Lognormal at 5% Significance Level                |       |   |   |   |   |
| 471 |   | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                  |       |   |   |                                                               |       |   |   |   |   |
| 472 |   |                                                                                                                                        |       |   |   |                                                               |       |   |   |   |   |
| 473 |   | <b>Lognormal Statistics</b>                                                                                                            |       |   |   |                                                               |       |   |   |   |   |
| 474 |   | Minimum of Logged Data                                                                                                                 | 4.013 |   |   | Mean of logged Data                                           | 4.57  |   |   |   |   |
| 475 |   | Maximum of Logged Data                                                                                                                 | 5.147 |   |   | SD of logged Data                                             | 0.44  |   |   |   |   |
| 476 |   |                                                                                                                                        |       |   |   |                                                               |       |   |   |   |   |
| 477 |   | <b>Assuming Lognormal Distribution</b>                                                                                                 |       |   |   |                                                               |       |   |   |   |   |
| 478 |   | 95% H-UCL                                                                                                                              | 162   |   |   | 90% Chebyshev (MVUE) UCL                                      | 157.3 |   |   |   |   |
| 479 |   | 95% Chebyshev (MVUE) UCL                                                                                                               | 181.1 |   |   | 97.5% Chebyshev (MVUE) UCL                                    | 214.1 |   |   |   |   |
| 480 |   | 99% Chebyshev (MVUE) UCL                                                                                                               | 279   |   |   |                                                               |       |   |   |   |   |
| 481 |   |                                                                                                                                        |       |   |   |                                                               |       |   |   |   |   |
| 482 |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                  |       |   |   |                                                               |       |   |   |   |   |
| 483 |   | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                       |       |   |   |                                                               |       |   |   |   |   |
| 484 |   |                                                                                                                                        |       |   |   |                                                               |       |   |   |   |   |
| 485 |   | <b>Nonparametric Distribution Free UCLs</b>                                                                                            |       |   |   |                                                               |       |   |   |   |   |
| 486 |   | 95% CLT UCL                                                                                                                            | 132.5 |   |   | 95% Jackknife UCL                                             | 137.5 |   |   |   |   |
| 487 |   | 95% Standard Bootstrap UCL                                                                                                             | 130.6 |   |   | 95% Bootstrap-t UCL                                           | 146.7 |   |   |   |   |
| 488 |   | 95% Hall's Bootstrap UCL                                                                                                               | 130.7 |   |   | 95% Percentile Bootstrap UCL                                  | 131.7 |   |   |   |   |
| 489 |   | 95% BCA Bootstrap UCL                                                                                                                  | 133   |   |   |                                                               |       |   |   |   |   |
| 490 |   | 90% Chebyshev(Mean, Sd) UCL                                                                                                            | 155.4 |   |   | 95% Chebyshev(Mean, Sd) UCL                                   | 178.3 |   |   |   |   |
| 491 |   | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                          | 210.1 |   |   | 99% Chebyshev(Mean, Sd) UCL                                   | 272.6 |   |   |   |   |
| 492 |   |                                                                                                                                        |       |   |   |                                                               |       |   |   |   |   |
| 493 |   | <b>Suggested UCL to Use</b>                                                                                                            |       |   |   |                                                               |       |   |   |   |   |
| 494 |   | 95% Student's-t UCL                                                                                                                    | 137.5 |   |   |                                                               |       |   |   |   |   |
| 495 |   |                                                                                                                                        |       |   |   |                                                               |       |   |   |   |   |
| 496 |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.           |       |   |   |                                                               |       |   |   |   |   |
| 497 |   | Recommendations are based upon data size, data distribution, and skewness.                                                             |       |   |   |                                                               |       |   |   |   |   |
| 498 |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).               |       |   |   |                                                               |       |   |   |   |   |
| 499 |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistica |       |   |   |                                                               |       |   |   |   |   |
| 500 |   |                                                                                                                                        |       |   |   |                                                               |       |   |   |   |   |
| 501 |   |                                                                                                                                        |       |   |   |                                                               |       |   |   |   |   |
| 502 |   | <b>Result (eu6_strontium)</b>                                                                                                          |       |   |   |                                                               |       |   |   |   |   |
| 503 |   |                                                                                                                                        |       |   |   |                                                               |       |   |   |   |   |
| 504 |   | <b>General Statistics</b>                                                                                                              |       |   |   |                                                               |       |   |   |   |   |
| 505 |   | Total Number of Observations                                                                                                           | 6     |   |   | Number of Distinct Observations                               | 6     |   |   |   |   |
| 506 |   |                                                                                                                                        |       |   |   | Number of Missing Observations                                | 0     |   |   |   |   |
| 507 |   | Minimum                                                                                                                                | 86    |   |   | Mean                                                          | 141.4 |   |   |   |   |
| 508 |   | Maximum                                                                                                                                | 245   |   |   | Median                                                        | 128.5 |   |   |   |   |
| 509 |   | SD                                                                                                                                     | 64.39 |   |   | Std. Error of Mean                                            | 26.29 |   |   |   |   |
| 510 |   | Coefficient of Variation                                                                                                               | 0.455 |   |   | Skewness                                                      | 0.796 |   |   |   |   |
| 511 |   |                                                                                                                                        |       |   |   |                                                               |       |   |   |   |   |
| 512 |   | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                             |       |   |   |                                                               |       |   |   |   |   |
| 513 |   | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                 |       |   |   |                                                               |       |   |   |   |   |
| 514 |   | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                    |       |   |   |                                                               |       |   |   |   |   |
| 515 |   | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                         |       |   |   |                                                               |       |   |   |   |   |
| 516 |   |                                                                                                                                        |       |   |   |                                                               |       |   |   |   |   |
| 517 |   | <b>Normal GOF Test</b>                                                                                                                 |       |   |   |                                                               |       |   |   |   |   |
| 518 |   | Shapiro Wilk Test Statistic                                                                                                            | 0.853 |   |   | <b>Shapiro Wilk GOF Test</b>                                  |       |   |   |   |   |
| 519 |   | 5% Shapiro Wilk Critical Value                                                                                                         | 0.788 |   |   | Data appear Normal at 5% Significance Level                   |       |   |   |   |   |
| 520 |   | Lilliefors Test Statistic                                                                                                              | 0.274 |   |   | <b>Lilliefors GOF Test</b>                                    |       |   |   |   |   |
| 521 |   | 5% Lilliefors Critical Value                                                                                                           | 0.325 |   |   | Data appear Normal at 5% Significance Level                   |       |   |   |   |   |
| 522 |   | <b>Data appear Normal at 5% Significance Level</b>                                                                                     |       |   |   |                                                               |       |   |   |   |   |
| 523 |   |                                                                                                                                        |       |   |   |                                                               |       |   |   |   |   |
| 524 |   | <b>Assuming Normal Distribution</b>                                                                                                    |       |   |   |                                                               |       |   |   |   |   |
| 525 |   | <b>95% Normal UCL</b>                                                                                                                  |       |   |   | <b>95% UCLs (Adjusted for Skewness)</b>                       |       |   |   |   |   |
| 526 |   | 95% Student's-t UCL                                                                                                                    | 194.4 |   |   | 95% Adjusted-CLT UCL (Chen-1995)                              | 193.8 |   |   |   |   |
| 527 |   |                                                                                                                                        |       |   |   | 95% Modified-t UCL (Johnson-1978)                             | 195.8 |   |   |   |   |
| 528 |   |                                                                                                                                        |       |   |   |                                                               |       |   |   |   |   |
| 529 |   | <b>Gamma GOF Test</b>                                                                                                                  |       |   |   |                                                               |       |   |   |   |   |
| 530 |   | A-D Test Statistic                                                                                                                     | 0.521 |   |   | <b>Anderson-Darling Gamma GOF Test</b>                        |       |   |   |   |   |
| 531 |   | 5% A-D Critical Value                                                                                                                  | 0.698 |   |   | Detected data appear Gamma Distributed at 5% Significance Lev |       |   |   |   |   |
| 532 |   | K-S Test Statistic                                                                                                                     | 0.297 |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                      |       |   |   |   |   |
| 533 |   | 5% K-S Critical Value                                                                                                                  | 0.333 |   |   | Detected data appear Gamma Distributed at 5% Significance Lev |       |   |   |   |   |
| 534 |   | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                 |       |   |   |                                                               |       |   |   |   |   |
| 535 |   |                                                                                                                                        |       |   |   |                                                               |       |   |   |   |   |
| 536 |   | <b>Gamma Statistics</b>                                                                                                                |       |   |   |                                                               |       |   |   |   |   |

| A   | B | C | D | E                                                                                                                                        | F      | G | H | I | J                                              | K | L      |
|-----|---|---|---|------------------------------------------------------------------------------------------------------------------------------------------|--------|---|---|---|------------------------------------------------|---|--------|
| 537 |   |   |   | k hat (MLE)                                                                                                                              | 6.126  |   |   |   | k star (bias corrected MLE)                    |   | 3.174  |
| 538 |   |   |   | Theta hat (MLE)                                                                                                                          | 23.08  |   |   |   | Theta star (bias corrected MLE)                |   | 44.55  |
| 539 |   |   |   | nu hat (MLE)                                                                                                                             | 73.51  |   |   |   | nu star (bias corrected)                       |   | 38.09  |
| 540 |   |   |   | MLE Mean (bias corrected)                                                                                                                | 141.4  |   |   |   | MLE Sd (bias corrected)                        |   | 79.38  |
| 541 |   |   |   |                                                                                                                                          |        |   |   |   | Approximate Chi Square Value (0.05)            |   | 24.96  |
| 542 |   |   |   | Adjusted Level of Significance                                                                                                           | 0.0122 |   |   |   | Adjusted Chi Square Value                      |   | 21.2   |
| 543 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |        |
| 544 |   |   |   | <b>Assuming Gamma Distribution</b>                                                                                                       |        |   |   |   |                                                |   |        |
| 545 |   |   |   | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | 215.8  |   |   |   | 95% Adjusted Gamma UCL (use when n<50)         |   | 254.1  |
| 546 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |        |
| 547 |   |   |   | <b>Lognormal GOF Test</b>                                                                                                                |        |   |   |   |                                                |   |        |
| 548 |   |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.854  |   |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>         |   |        |
| 549 |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                           | 0.788  |   |   |   | Data appear Lognormal at 5% Significance Level |   |        |
| 550 |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.274  |   |   |   | <b>Lilliefors Lognormal GOF Test</b>           |   |        |
| 551 |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.325  |   |   |   | Data appear Lognormal at 5% Significance Level |   |        |
| 552 |   |   |   | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |        |   |   |   |                                                |   |        |
| 553 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |        |
| 554 |   |   |   | <b>Lognormal Statistics</b>                                                                                                              |        |   |   |   |                                                |   |        |
| 555 |   |   |   | Minimum of Logged Data                                                                                                                   | 4.454  |   |   |   | Mean of logged Data                            |   | 4.868  |
| 556 |   |   |   | Maximum of Logged Data                                                                                                                   | 5.501  |   |   |   | SD of logged Data                              |   | 0.445  |
| 557 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |        |
| 558 |   |   |   | <b>Assuming Lognormal Distribution</b>                                                                                                   |        |   |   |   |                                                |   |        |
| 559 |   |   |   | 95% H-UCL                                                                                                                                | 236.6  |   |   |   | 90% Chebyshev (MVUE) UCL                       |   | 217.9  |
| 560 |   |   |   | 95% Chebyshev (MVUE) UCL                                                                                                                 | 252.7  |   |   |   | 97.5% Chebyshev (MVUE) UCL                     |   | 301    |
| 561 |   |   |   | 99% Chebyshev (MVUE) UCL                                                                                                                 | 395.8  |   |   |   |                                                |   |        |
| 562 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |        |
| 563 |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |   |   |   |                                                |   |        |
| 564 |   |   |   | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |        |   |   |   |                                                |   |        |
| 565 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |        |
| 566 |   |   |   | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |        |   |   |   |                                                |   |        |
| 567 |   |   |   | 95% CLT UCL                                                                                                                              | 184.7  |   |   |   | 95% Jackknife UCL                              |   | 194.4  |
| 568 |   |   |   | 95% Standard Bootstrap UCL                                                                                                               | 181    |   |   |   | 95% Bootstrap-t UCL                            |   | 214.2  |
| 569 |   |   |   | 95% Hall's Bootstrap UCL                                                                                                                 | 179.6  |   |   |   | 95% Percentile Bootstrap UCL                   |   | 181.3  |
| 570 |   |   |   | 95% BCA Bootstrap UCL                                                                                                                    | 182.5  |   |   |   |                                                |   |        |
| 571 |   |   |   | 90% Chebyshev(Mean, Sd) UCL                                                                                                              | 220.3  |   |   |   | 95% Chebyshev(Mean, Sd) UCL                    |   | 256    |
| 572 |   |   |   | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            | 305.6  |   |   |   | 99% Chebyshev(Mean, Sd) UCL                    |   | 403    |
| 573 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |        |
| 574 |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |        |   |   |   |                                                |   |        |
| 575 |   |   |   | 95% Student's-t UCL                                                                                                                      | 194.4  |   |   |   |                                                |   |        |
| 576 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |        |
| 577 |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |   |   |   |                                                |   |        |
| 578 |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |   |   |   |                                                |   |        |
| 579 |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |   |   |   |                                                |   |        |
| 580 |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |   |   |   |                                                |   |        |
| 581 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |        |
| 582 |   |   |   | <b>Result (eu6_thallium)</b>                                                                                                             |        |   |   |   |                                                |   |        |
| 583 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |        |
| 584 |   |   |   | <b>General Statistics</b>                                                                                                                |        |   |   |   |                                                |   |        |
| 585 |   |   |   | Total Number of Observations                                                                                                             | 7      |   |   |   | Number of Distinct Observations                |   | 4      |
| 586 |   |   |   | Number of Detects                                                                                                                        | 2      |   |   |   | Number of Non-Detects                          |   | 5      |
| 587 |   |   |   | Number of Distinct Detects                                                                                                               | 2      |   |   |   | Number of Distinct Non-Detects                 |   | 2      |
| 588 |   |   |   | Minimum Detect                                                                                                                           | 7.87   |   |   |   | Minimum Non-Detect                             |   | 0.031  |
| 589 |   |   |   | Maximum Detect                                                                                                                           | 8.53   |   |   |   | Maximum Non-Detect                             |   | 5      |
| 590 |   |   |   | Variance Detects                                                                                                                         | 0.218  |   |   |   | Percent Non-Detects                            |   | 71.43% |
| 591 |   |   |   | Mean Detects                                                                                                                             | 8.2    |   |   |   | SD Detects                                     |   | 0.467  |
| 592 |   |   |   | Median Detects                                                                                                                           | 8.2    |   |   |   | CV Detects                                     |   | 0.0569 |
| 593 |   |   |   | Skewness Detects                                                                                                                         | N/A    |   |   |   | Kurtosis Detects                               |   | N/A    |
| 594 |   |   |   | Mean of Logged Detects                                                                                                                   | 2.103  |   |   |   | SD of Logged Detects                           |   | 0.0569 |
| 595 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |        |
| 596 |   |   |   | <b>Warning: Data set has only 2 Detected Values.</b>                                                                                     |        |   |   |   |                                                |   |        |
| 597 |   |   |   | <b>This is not enough to compute meaningful or reliable statistics and estimates.</b>                                                    |        |   |   |   |                                                |   |        |
| 598 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |        |
| 599 |   |   |   |                                                                                                                                          |        |   |   |   |                                                |   |        |
| 600 |   |   |   | Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use                                         |        |   |   |   |                                                |   |        |
| 601 |   |   |   | guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.                                          |        |   |   |   |                                                |   |        |
| 602 |   |   |   | For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).                                                             |        |   |   |   |                                                |   |        |
| 603 |   |   |   | Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1                                                  |        |   |   |   |                                                |   |        |



| A   | B                                                                                                                                      | C      | D | E | F                                       | G                                                             | H     | I | J | K | L |
|-----|----------------------------------------------------------------------------------------------------------------------------------------|--------|---|---|-----------------------------------------|---------------------------------------------------------------|-------|---|---|---|---|
| 671 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.           |        |   |   |                                         |                                                               |       |   |   |   |   |
| 672 | Recommendations are based upon data size, data distribution, and skewness.                                                             |        |   |   |                                         |                                                               |       |   |   |   |   |
| 673 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).               |        |   |   |                                         |                                                               |       |   |   |   |   |
| 674 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistica |        |   |   |                                         |                                                               |       |   |   |   |   |
| 675 |                                                                                                                                        |        |   |   |                                         |                                                               |       |   |   |   |   |
| 676 |                                                                                                                                        |        |   |   |                                         |                                                               |       |   |   |   |   |
| 677 | <b>Result (eu6_zinc)</b>                                                                                                               |        |   |   |                                         |                                                               |       |   |   |   |   |
| 678 |                                                                                                                                        |        |   |   |                                         |                                                               |       |   |   |   |   |
| 679 | <b>General Statistics</b>                                                                                                              |        |   |   |                                         |                                                               |       |   |   |   |   |
| 680 | Total Number of Observations                                                                                                           | 7      |   |   |                                         | Number of Distinct Observations                               | 7     |   |   |   |   |
| 681 |                                                                                                                                        |        |   |   |                                         | Number of Missing Observations                                | 0     |   |   |   |   |
| 682 | Minimum                                                                                                                                | 17.3   |   |   |                                         | Mean                                                          | 41.24 |   |   |   |   |
| 683 | Maximum                                                                                                                                | 85.2   |   |   |                                         | Median                                                        | 31.3  |   |   |   |   |
| 684 | SD                                                                                                                                     | 26.25  |   |   |                                         | Std. Error of Mean                                            | 9.922 |   |   |   |   |
| 685 | Coefficient of Variation                                                                                                               | 0.637  |   |   |                                         | Skewness                                                      | 0.929 |   |   |   |   |
| 686 |                                                                                                                                        |        |   |   |                                         |                                                               |       |   |   |   |   |
| 687 | <b>Note: Sample size is small (e.g., &lt;10), if data are collected using ISM approach, you should use</b>                             |        |   |   |                                         |                                                               |       |   |   |   |   |
| 688 | <b>guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.</b>                                 |        |   |   |                                         |                                                               |       |   |   |   |   |
| 689 | <b>For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).</b>                                                    |        |   |   |                                         |                                                               |       |   |   |   |   |
| 690 | <b>Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1</b>                                         |        |   |   |                                         |                                                               |       |   |   |   |   |
| 691 |                                                                                                                                        |        |   |   |                                         |                                                               |       |   |   |   |   |
| 692 | <b>Normal GOF Test</b>                                                                                                                 |        |   |   |                                         |                                                               |       |   |   |   |   |
| 693 | Shapiro Wilk Test Statistic                                                                                                            | 0.867  |   |   |                                         | <b>Shapiro Wilk GOF Test</b>                                  |       |   |   |   |   |
| 694 | 5% Shapiro Wilk Critical Value                                                                                                         | 0.803  |   |   |                                         | Data appear Normal at 5% Significance Level                   |       |   |   |   |   |
| 695 | Lilliefors Test Statistic                                                                                                              | 0.219  |   |   |                                         | <b>Lilliefors GOF Test</b>                                    |       |   |   |   |   |
| 696 | 5% Lilliefors Critical Value                                                                                                           | 0.304  |   |   |                                         | Data appear Normal at 5% Significance Level                   |       |   |   |   |   |
| 697 | <b>Data appear Normal at 5% Significance Level</b>                                                                                     |        |   |   |                                         |                                                               |       |   |   |   |   |
| 698 |                                                                                                                                        |        |   |   |                                         |                                                               |       |   |   |   |   |
| 699 | <b>Assuming Normal Distribution</b>                                                                                                    |        |   |   |                                         |                                                               |       |   |   |   |   |
| 700 | <b>95% Normal UCL</b>                                                                                                                  |        |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |                                                               |       |   |   |   |   |
| 701 | 95% Student's-t UCL                                                                                                                    | 60.52  |   |   |                                         | 95% Adjusted-CLT UCL (Chen-1995)                              | 61.29 |   |   |   |   |
| 702 |                                                                                                                                        |        |   |   |                                         | 95% Modified-t UCL (Johnson-1978)                             | 61.1  |   |   |   |   |
| 703 |                                                                                                                                        |        |   |   |                                         |                                                               |       |   |   |   |   |
| 704 | <b>Gamma GOF Test</b>                                                                                                                  |        |   |   |                                         |                                                               |       |   |   |   |   |
| 705 | A-D Test Statistic                                                                                                                     | 0.392  |   |   |                                         | <b>Anderson-Darling Gamma GOF Test</b>                        |       |   |   |   |   |
| 706 | 5% A-D Critical Value                                                                                                                  | 0.712  |   |   |                                         | Detected data appear Gamma Distributed at 5% Significance Lev |       |   |   |   |   |
| 707 | K-S Test Statistic                                                                                                                     | 0.234  |   |   |                                         | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                      |       |   |   |   |   |
| 708 | 5% K-S Critical Value                                                                                                                  | 0.314  |   |   |                                         | Detected data appear Gamma Distributed at 5% Significance Lev |       |   |   |   |   |
| 709 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                 |        |   |   |                                         |                                                               |       |   |   |   |   |
| 710 |                                                                                                                                        |        |   |   |                                         |                                                               |       |   |   |   |   |
| 711 | <b>Gamma Statistics</b>                                                                                                                |        |   |   |                                         |                                                               |       |   |   |   |   |
| 712 | k hat (MLE)                                                                                                                            | 3.12   |   |   |                                         | k star (bias corrected MLE)                                   | 1.878 |   |   |   |   |
| 713 | Theta hat (MLE)                                                                                                                        | 13.22  |   |   |                                         | Theta star (bias corrected MLE)                               | 21.96 |   |   |   |   |
| 714 | nu hat (MLE)                                                                                                                           | 43.68  |   |   |                                         | nu star (bias corrected)                                      | 26.29 |   |   |   |   |
| 715 | MLE Mean (bias corrected)                                                                                                              | 41.24  |   |   |                                         | MLE Sd (bias corrected)                                       | 30.09 |   |   |   |   |
| 716 |                                                                                                                                        |        |   |   |                                         | Approximate Chi Square Value (0.05)                           | 15.61 |   |   |   |   |
| 717 | Adjusted Level of Significance                                                                                                         | 0.0158 |   |   |                                         | Adjusted Chi Square Value                                     | 13.19 |   |   |   |   |
| 718 |                                                                                                                                        |        |   |   |                                         |                                                               |       |   |   |   |   |
| 719 | <b>Assuming Gamma Distribution</b>                                                                                                     |        |   |   |                                         |                                                               |       |   |   |   |   |
| 720 | 95% Approximate Gamma UCL (use when n>=50))                                                                                            | 69.49  |   |   |                                         | 95% Adjusted Gamma UCL (use when n<50)                        | 82.24 |   |   |   |   |
| 721 |                                                                                                                                        |        |   |   |                                         |                                                               |       |   |   |   |   |
| 722 | <b>Lognormal GOF Test</b>                                                                                                              |        |   |   |                                         |                                                               |       |   |   |   |   |
| 723 | Shapiro Wilk Test Statistic                                                                                                            | 0.915  |   |   |                                         | <b>Shapiro Wilk Lognormal GOF Test</b>                        |       |   |   |   |   |
| 724 | 5% Shapiro Wilk Critical Value                                                                                                         | 0.803  |   |   |                                         | Data appear Lognormal at 5% Significance Level                |       |   |   |   |   |
| 725 | Lilliefors Test Statistic                                                                                                              | 0.216  |   |   |                                         | <b>Lilliefors Lognormal GOF Test</b>                          |       |   |   |   |   |
| 726 | 5% Lilliefors Critical Value                                                                                                           | 0.304  |   |   |                                         | Data appear Lognormal at 5% Significance Level                |       |   |   |   |   |
| 727 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                  |        |   |   |                                         |                                                               |       |   |   |   |   |
| 728 |                                                                                                                                        |        |   |   |                                         |                                                               |       |   |   |   |   |
| 729 | <b>Lognormal Statistics</b>                                                                                                            |        |   |   |                                         |                                                               |       |   |   |   |   |
| 730 | Minimum of Logged Data                                                                                                                 | 2.851  |   |   |                                         | Mean of logged Data                                           | 3.551 |   |   |   |   |
| 731 | Maximum of Logged Data                                                                                                                 | 4.445  |   |   |                                         | SD of logged Data                                             | 0.622 |   |   |   |   |
| 732 |                                                                                                                                        |        |   |   |                                         |                                                               |       |   |   |   |   |
| 733 | <b>Assuming Lognormal Distribution</b>                                                                                                 |        |   |   |                                         |                                                               |       |   |   |   |   |
| 734 | 95% H-UCL                                                                                                                              | 84.41  |   |   |                                         | 90% Chebyshev (MVUE) UCL                                      | 70.09 |   |   |   |   |
| 735 | 95% Chebyshev (MVUE) UCL                                                                                                               | 83.27  |   |   |                                         | 97.5% Chebyshev (MVUE) UCL                                    | 101.6 |   |   |   |   |
| 736 | 99% Chebyshev (MVUE) UCL                                                                                                               | 137.5  |   |   |                                         |                                                               |       |   |   |   |   |
| 737 |                                                                                                                                        |        |   |   |                                         |                                                               |       |   |   |   |   |

| A   | B                                                                                                                                        | C | D       | E                                                            | F | G | H | I | J | K | L      |  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---------|--------------------------------------------------------------|---|---|---|---|---|---|--------|--|
| 738 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |         |                                                              |   |   |   |   |   |   |        |  |
| 739 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |         |                                                              |   |   |   |   |   |   |        |  |
| 740 |                                                                                                                                          |   |         |                                                              |   |   |   |   |   |   |        |  |
| 741 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |         |                                                              |   |   |   |   |   |   |        |  |
| 742 | 95% CLT UCL                                                                                                                              |   | 57.56   | 95% Jackknife UCL                                            |   |   |   |   |   |   | 60.52  |  |
| 743 | 95% Standard Bootstrap UCL                                                                                                               |   | 56.3    | 95% Bootstrap-t UCL                                          |   |   |   |   |   |   | 79.22  |  |
| 744 | 95% Hall's Bootstrap UCL                                                                                                                 |   | 69.4    | 95% Percentile Bootstrap UCL                                 |   |   |   |   |   |   | 57.07  |  |
| 745 | 95% BCA Bootstrap UCL                                                                                                                    |   | 58.76   |                                                              |   |   |   |   |   |   |        |  |
| 746 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 71.01   | 95% Chebyshev(Mean, Sd) UCL                                  |   |   |   |   |   |   | 84.49  |  |
| 747 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 103.2   | 99% Chebyshev(Mean, Sd) UCL                                  |   |   |   |   |   |   | 140    |  |
| 748 |                                                                                                                                          |   |         |                                                              |   |   |   |   |   |   |        |  |
| 749 | <b>Suggested UCL to Use</b>                                                                                                              |   |         |                                                              |   |   |   |   |   |   |        |  |
| 750 | 95% Student's-t UCL                                                                                                                      |   | 60.52   |                                                              |   |   |   |   |   |   |        |  |
| 751 |                                                                                                                                          |   |         |                                                              |   |   |   |   |   |   |        |  |
| 752 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |         |                                                              |   |   |   |   |   |   |        |  |
| 753 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |         |                                                              |   |   |   |   |   |   |        |  |
| 754 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |         |                                                              |   |   |   |   |   |   |        |  |
| 755 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |         |                                                              |   |   |   |   |   |   |        |  |
| 756 |                                                                                                                                          |   |         |                                                              |   |   |   |   |   |   |        |  |
| 757 | <b>Result (eu7_aluminum)</b>                                                                                                             |   |         |                                                              |   |   |   |   |   |   |        |  |
| 758 |                                                                                                                                          |   |         |                                                              |   |   |   |   |   |   |        |  |
| 759 | <b>General Statistics</b>                                                                                                                |   |         |                                                              |   |   |   |   |   |   |        |  |
| 760 | Total Number of Observations                                                                                                             |   | 152     | Number of Distinct Observations                              |   |   |   |   |   |   | 142    |  |
| 761 | Number of Detects                                                                                                                        |   | 149     | Number of Non-Detects                                        |   |   |   |   |   |   | 3      |  |
| 762 | Number of Distinct Detects                                                                                                               |   | 141     | Number of Distinct Non-Detects                               |   |   |   |   |   |   | 1      |  |
| 763 | Minimum Detect                                                                                                                           |   | 20.1    | Minimum Non-Detect                                           |   |   |   |   |   |   | 20     |  |
| 764 | Maximum Detect                                                                                                                           |   | 8290    | Maximum Non-Detect                                           |   |   |   |   |   |   | 20     |  |
| 765 | Variance Detects                                                                                                                         |   | 2083135 | Percent Non-Detects                                          |   |   |   |   |   |   | 1.9749 |  |
| 766 | Mean Detects                                                                                                                             |   | 662.5   | SD Detects                                                   |   |   |   |   |   |   | 1443   |  |
| 767 | Median Detects                                                                                                                           |   | 143     | CV Detects                                                   |   |   |   |   |   |   | 2.178  |  |
| 768 | Skewness Detects                                                                                                                         |   | 3.506   | Kurtosis Detects                                             |   |   |   |   |   |   | 12.42  |  |
| 769 | Mean of Logged Detects                                                                                                                   |   | 5.254   | SD of Logged Detects                                         |   |   |   |   |   |   | 1.445  |  |
| 770 |                                                                                                                                          |   |         |                                                              |   |   |   |   |   |   |        |  |
| 771 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |         |                                                              |   |   |   |   |   |   |        |  |
| 772 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.476   | <b>Normal GOF Test on Detected Observations Only</b>         |   |   |   |   |   |   |        |  |
| 773 | 5% Shapiro Wilk P Value                                                                                                                  |   | 0       | Detected Data Not Normal at 5% Significance Level            |   |   |   |   |   |   |        |  |
| 774 | Lilliefors Test Statistic                                                                                                                |   | 0.328   | <b>Lilliefors GOF Test</b>                                   |   |   |   |   |   |   |        |  |
| 775 | 5% Lilliefors Critical Value                                                                                                             |   | 0.073   | Detected Data Not Normal at 5% Significance Level            |   |   |   |   |   |   |        |  |
| 776 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |   |         |                                                              |   |   |   |   |   |   |        |  |
| 777 |                                                                                                                                          |   |         |                                                              |   |   |   |   |   |   |        |  |
| 778 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |         |                                                              |   |   |   |   |   |   |        |  |
| 779 | KM Mean                                                                                                                                  |   | 649.9   | KM Standard Error of Mean                                    |   |   |   |   |   |   | 116.1  |  |
| 780 | KM SD                                                                                                                                    |   | 1427    | 95% KM (BCA) UCL                                             |   |   |   |   |   |   | 853.4  |  |
| 781 | 95% KM (t) UCL                                                                                                                           |   | 842.1   | 95% KM (Percentile Bootstrap) UCL                            |   |   |   |   |   |   | 841.9  |  |
| 782 | 95% KM (z) UCL                                                                                                                           |   | 840.9   | 95% KM Bootstrap t UCL                                       |   |   |   |   |   |   | 913.7  |  |
| 783 | 90% KM Chebyshev UCL                                                                                                                     |   | 998.3   | 95% KM Chebyshev UCL                                         |   |   |   |   |   |   | 1156   |  |
| 784 | 97.5% KM Chebyshev UCL                                                                                                                   |   | 1375    | 99% KM Chebyshev UCL                                         |   |   |   |   |   |   | 1805   |  |
| 785 |                                                                                                                                          |   |         |                                                              |   |   |   |   |   |   |        |  |
| 786 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |   |         |                                                              |   |   |   |   |   |   |        |  |
| 787 | A-D Test Statistic                                                                                                                       |   | 10.39   | <b>Anderson-Darling GOF Test</b>                             |   |   |   |   |   |   |        |  |
| 788 | 5% A-D Critical Value                                                                                                                    |   | 0.819   | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |   |   |   |   |        |  |
| 789 | K-S Test Statistic                                                                                                                       |   | 0.209   | <b>Kolmogorov-Smirnov GOF</b>                                |   |   |   |   |   |   |        |  |
| 790 | 5% K-S Critical Value                                                                                                                    |   | 0.0812  | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |   |   |   |   |        |  |
| 791 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                                      |   |         |                                                              |   |   |   |   |   |   |        |  |
| 792 |                                                                                                                                          |   |         |                                                              |   |   |   |   |   |   |        |  |
| 793 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |   |         |                                                              |   |   |   |   |   |   |        |  |
| 794 | k hat (MLE)                                                                                                                              |   | 0.51    | k star (bias corrected MLE)                                  |   |   |   |   |   |   | 0.504  |  |
| 795 | Theta hat (MLE)                                                                                                                          |   | 1300    | Theta star (bias corrected MLE)                              |   |   |   |   |   |   | 1315   |  |
| 796 | nu hat (MLE)                                                                                                                             |   | 151.9   | nu star (bias corrected)                                     |   |   |   |   |   |   | 150.2  |  |
| 797 | Mean (detects)                                                                                                                           |   | 662.5   |                                                              |   |   |   |   |   |   |        |  |
| 798 |                                                                                                                                          |   |         |                                                              |   |   |   |   |   |   |        |  |
| 799 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |   |         |                                                              |   |   |   |   |   |   |        |  |
| 800 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |   |         |                                                              |   |   |   |   |   |   |        |  |
| 801 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |   |         |                                                              |   |   |   |   |   |   |        |  |
| 802 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |   |         |                                                              |   |   |   |   |   |   |        |  |
| 803 | This is especially true when the sample size is small.                                                                                   |   |         |                                                              |   |   |   |   |   |   |        |  |
| 804 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |   |         |                                                              |   |   |   |   |   |   |        |  |

|     | A                                                                                                                                        | B | C | D | E                                                   | F         | G                           | H | I | J | K                                                    | L     |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|-----------------------------------------------------|-----------|-----------------------------|---|---|---|------------------------------------------------------|-------|
| 805 |                                                                                                                                          |   |   |   | Minimum                                             | 0.01      |                             |   |   |   | Mean                                                 | 649.5 |
| 806 |                                                                                                                                          |   |   |   | Maximum                                             | 8290      |                             |   |   |   | Median                                               | 135   |
| 807 |                                                                                                                                          |   |   |   | SD                                                  | 1432      |                             |   |   |   | CV                                                   | 2.205 |
| 808 |                                                                                                                                          |   |   |   | k hat (MLE)                                         | 0.455     |                             |   |   |   | k star (bias corrected MLE)                          | 0.45  |
| 809 |                                                                                                                                          |   |   |   | Theta hat (MLE)                                     | 1427      |                             |   |   |   | Theta star (bias corrected MLE)                      | 1442  |
| 810 |                                                                                                                                          |   |   |   | nu hat (MLE)                                        | 138.3     |                             |   |   |   | nu star (bias corrected)                             | 136.9 |
| 811 |                                                                                                                                          |   |   |   | Adjusted Level of Significance ( $\beta$ )          | 0.0484    |                             |   |   |   |                                                      |       |
| 812 |                                                                                                                                          |   |   |   | Approximate Chi Square Value (136.92, $\alpha$ )    | 110.9     |                             |   |   |   | Adjusted Chi Square Value (136.92, $\beta$ )         | 110.7 |
| 813 |                                                                                                                                          |   |   |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )   | 802       |                             |   |   |   | 95% Gamma Adjusted UCL (use when $n < 50$ )          | 803.6 |
| 814 |                                                                                                                                          |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 815 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 816 |                                                                                                                                          |   |   |   | Mean (KM)                                           | 649.9     |                             |   |   |   | SD (KM)                                              | 1427  |
| 817 |                                                                                                                                          |   |   |   | Variance (KM)                                       | 2036304   |                             |   |   |   | SE of Mean (KM)                                      | 116.1 |
| 818 |                                                                                                                                          |   |   |   | k hat (KM)                                          | 0.207     |                             |   |   |   | k star (KM)                                          | 0.208 |
| 819 |                                                                                                                                          |   |   |   | nu hat (KM)                                         | 63.05     |                             |   |   |   | nu star (KM)                                         | 63.14 |
| 820 |                                                                                                                                          |   |   |   | theta hat (KM)                                      | 3133      |                             |   |   |   | theta star (KM)                                      | 3129  |
| 821 |                                                                                                                                          |   |   |   | 80% gamma percentile (KM)                           | 872.9     |                             |   |   |   | 90% gamma percentile (KM)                            | 1965  |
| 822 |                                                                                                                                          |   |   |   | 95% gamma percentile (KM)                           | 3315      |                             |   |   |   | 99% gamma percentile (KM)                            | 7009  |
| 823 |                                                                                                                                          |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 824 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 825 |                                                                                                                                          |   |   |   | Approximate Chi Square Value (63.14, $\alpha$ )     | 45.86     |                             |   |   |   | Adjusted Chi Square Value (63.14, $\beta$ )          | 45.72 |
| 826 |                                                                                                                                          |   |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ ) | 894.7     |                             |   |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )       | 897.5 |
| 827 |                                                                                                                                          |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 828 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 829 |                                                                                                                                          |   |   |   | Shapiro Wilk Approximate Test Statistic             | 0.923     |                             |   |   |   | <b>Shapiro Wilk GOF Test</b>                         |       |
| 830 |                                                                                                                                          |   |   |   | 5% Shapiro Wilk P Value                             | 7.843E-10 |                             |   |   |   | Detected Data Not Lognormal at 5% Significance Level |       |
| 831 |                                                                                                                                          |   |   |   | Lilliefors Test Statistic                           | 0.0985    |                             |   |   |   | <b>Lilliefors GOF Test</b>                           |       |
| 832 |                                                                                                                                          |   |   |   | 5% Lilliefors Critical Value                        | 0.073     |                             |   |   |   | Detected Data Not Lognormal at 5% Significance Level |       |
| 833 | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                                              |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 834 |                                                                                                                                          |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 835 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 836 |                                                                                                                                          |   |   |   | Mean in Original Scale                              | 649.6     |                             |   |   |   | Mean in Log Scale                                    | 5.181 |
| 837 |                                                                                                                                          |   |   |   | SD in Original Scale                                | 1432      |                             |   |   |   | SD in Log Scale                                      | 1.52  |
| 838 |                                                                                                                                          |   |   |   | 95% t UCL (assumes normality of ROS data)           | 841.8     |                             |   |   |   | 95% Percentile Bootstrap UCL                         | 843.1 |
| 839 |                                                                                                                                          |   |   |   | 95% BCA Bootstrap UCL                               | 889.5     |                             |   |   |   | 95% Bootstrap t UCL                                  | 892.5 |
| 840 |                                                                                                                                          |   |   |   | 95% H-UCL (Log ROS)                                 | 792.1     |                             |   |   |   |                                                      |       |
| 841 |                                                                                                                                          |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 842 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 843 |                                                                                                                                          |   |   |   | KM Mean (logged)                                    | 5.209     |                             |   |   |   | KM Geo Mean                                          | 183   |
| 844 |                                                                                                                                          |   |   |   | KM SD (logged)                                      | 1.46      |                             |   |   |   | 95% Critical H Value (KM-Log)                        | 2.67  |
| 845 |                                                                                                                                          |   |   |   | KM Standard Error of Mean (logged)                  | 0.119     |                             |   |   |   | 95% H-UCL (KM -Log)                                  | 729.1 |
| 846 |                                                                                                                                          |   |   |   | KM SD (logged)                                      | 1.46      |                             |   |   |   | 95% Critical H Value (KM-Log)                        | 2.67  |
| 847 |                                                                                                                                          |   |   |   | KM Standard Error of Mean (logged)                  | 0.119     |                             |   |   |   |                                                      |       |
| 848 |                                                                                                                                          |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 849 | <b>DL/2 Statistics</b>                                                                                                                   |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 850 | <b>DL/2 Normal</b>                                                                                                                       |   |   |   |                                                     |           | <b>DL/2 Log-Transformed</b> |   |   |   |                                                      |       |
| 851 |                                                                                                                                          |   |   |   | Mean in Original Scale                              | 649.7     |                             |   |   |   | Mean in Log Scale                                    | 5.196 |
| 852 |                                                                                                                                          |   |   |   | SD in Original Scale                                | 1432      |                             |   |   |   | SD in Log Scale                                      | 1.488 |
| 853 |                                                                                                                                          |   |   |   | 95% t UCL (Assumes normality)                       | 841.9     |                             |   |   |   | 95% H-Stat UCL                                       | 757.9 |
| 854 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 855 |                                                                                                                                          |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 856 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 857 | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                            |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 858 |                                                                                                                                          |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 859 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 860 |                                                                                                                                          |   |   |   | 95% KM (Chebyshev) UCL                              | 1156      |                             |   |   |   |                                                      |       |
| 861 |                                                                                                                                          |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 862 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 863 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 864 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 865 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 866 |                                                                                                                                          |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 867 | <b>Result (eu7_antimony)</b>                                                                                                             |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 868 |                                                                                                                                          |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 869 | <b>General Statistics</b>                                                                                                                |   |   |   |                                                     |           |                             |   |   |   |                                                      |       |
| 870 |                                                                                                                                          |   |   |   | Total Number of Observations                        | 129       |                             |   |   |   | Number of Distinct Observations                      | 5     |
| 871 |                                                                                                                                          |   |   |   | Number of Detects                                   | 3         |                             |   |   |   | Number of Non-Detects                                | 126   |

|     | A                                                                                                                         | B | C | D | E      | F                                                    | G | H | I | J      | K | L |
|-----|---------------------------------------------------------------------------------------------------------------------------|---|---|---|--------|------------------------------------------------------|---|---|---|--------|---|---|
| 872 | Number of Distinct Detects                                                                                                |   |   |   | 3      | Number of Distinct Non-Detects                       |   |   |   | 2      |   |   |
| 873 | Minimum Detect                                                                                                            |   |   |   | 4.42   | Minimum Non-Detect                                   |   |   |   | 0.047  |   |   |
| 874 | Maximum Detect                                                                                                            |   |   |   | 5.04   | Maximum Non-Detect                                   |   |   |   | 2.5    |   |   |
| 875 | Variance Detects                                                                                                          |   |   |   | 0.0966 | Percent Non-Detects                                  |   |   |   | 97.67% |   |   |
| 876 | Mean Detects                                                                                                              |   |   |   | 4.717  | SD Detects                                           |   |   |   | 0.311  |   |   |
| 877 | Median Detects                                                                                                            |   |   |   | 4.69   | CV Detects                                           |   |   |   | 0.0659 |   |   |
| 878 | Skewness Detects                                                                                                          |   |   |   | 0.383  | Kurtosis Detects                                     |   |   |   | N/A    |   |   |
| 879 | Mean of Logged Detects                                                                                                    |   |   |   | 1.55   | SD of Logged Detects                                 |   |   |   | 0.0657 |   |   |
| 880 |                                                                                                                           |   |   |   |        |                                                      |   |   |   |        |   |   |
| 881 | <b>Warning: Data set has only 3 Detected Values.</b>                                                                      |   |   |   |        |                                                      |   |   |   |        |   |   |
| 882 | <b>This is not enough to compute meaningful or reliable statistics and estimates.</b>                                     |   |   |   |        |                                                      |   |   |   |        |   |   |
| 883 |                                                                                                                           |   |   |   |        |                                                      |   |   |   |        |   |   |
| 884 |                                                                                                                           |   |   |   |        |                                                      |   |   |   |        |   |   |
| 885 | <b>Normal GOF Test on Detects Only</b>                                                                                    |   |   |   |        |                                                      |   |   |   |        |   |   |
| 886 | Shapiro Wilk Test Statistic                                                                                               |   |   |   | 0.994  | <b>Shapiro Wilk GOF Test</b>                         |   |   |   |        |   |   |
| 887 | 5% Shapiro Wilk Critical Value                                                                                            |   |   |   | 0.767  | Detected Data appear Normal at 5% Significance Level |   |   |   |        |   |   |
| 888 | Lilliefors Test Statistic                                                                                                 |   |   |   | 0.201  | <b>Lilliefors GOF Test</b>                           |   |   |   |        |   |   |
| 889 | 5% Lilliefors Critical Value                                                                                              |   |   |   | 0.425  | Detected Data appear Normal at 5% Significance Level |   |   |   |        |   |   |
| 890 | <b>Detected Data appear Normal at 5% Significance Level</b>                                                               |   |   |   |        |                                                      |   |   |   |        |   |   |
| 891 |                                                                                                                           |   |   |   |        |                                                      |   |   |   |        |   |   |
| 892 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |   |   |   |        |                                                      |   |   |   |        |   |   |
| 893 | KM Mean                                                                                                                   |   |   |   | 0.156  | KM Standard Error of Mean                            |   |   |   | 0.076  |   |   |
| 894 | KM SD                                                                                                                     |   |   |   | 0.705  | 95% KM (BCA) UCL                                     |   |   |   | N/A    |   |   |
| 895 | 95% KM (t) UCL                                                                                                            |   |   |   | 0.282  | 95% KM (Percentile Bootstrap) UCL                    |   |   |   | N/A    |   |   |
| 896 | 95% KM (z) UCL                                                                                                            |   |   |   | 0.281  | 95% KM Bootstrap t UCL                               |   |   |   | N/A    |   |   |
| 897 | 90% KM Chebyshev UCL                                                                                                      |   |   |   | 0.384  | 95% KM Chebyshev UCL                                 |   |   |   | 0.487  |   |   |
| 898 | 97.5% KM Chebyshev UCL                                                                                                    |   |   |   | 0.63   | 99% KM Chebyshev UCL                                 |   |   |   | 0.912  |   |   |
| 899 |                                                                                                                           |   |   |   |        |                                                      |   |   |   |        |   |   |
| 900 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |   |        |                                                      |   |   |   |        |   |   |
| 901 | <b>Not Enough Data to Perform GOF Test</b>                                                                                |   |   |   |        |                                                      |   |   |   |        |   |   |
| 902 |                                                                                                                           |   |   |   |        |                                                      |   |   |   |        |   |   |
| 903 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |   |        |                                                      |   |   |   |        |   |   |
| 904 | k hat (MLE)                                                                                                               |   |   |   | 346.7  | k star (bias corrected MLE)                          |   |   |   | N/A    |   |   |
| 905 | Theta hat (MLE)                                                                                                           |   |   |   | 0.0136 | Theta star (bias corrected MLE)                      |   |   |   | N/A    |   |   |
| 906 | nu hat (MLE)                                                                                                              |   |   |   | 2080   | nu star (bias corrected)                             |   |   |   | N/A    |   |   |
| 907 | Mean (detects)                                                                                                            |   |   |   | 4.717  |                                                      |   |   |   |        |   |   |
| 908 |                                                                                                                           |   |   |   |        |                                                      |   |   |   |        |   |   |
| 909 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |   |        |                                                      |   |   |   |        |   |   |
| 910 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |   |        |                                                      |   |   |   |        |   |   |
| 911 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |   |        |                                                      |   |   |   |        |   |   |
| 912 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |   |        |                                                      |   |   |   |        |   |   |
| 913 | This is especially true when the sample size is small.                                                                    |   |   |   |        |                                                      |   |   |   |        |   |   |
| 914 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |   |        |                                                      |   |   |   |        |   |   |
| 915 | Minimum                                                                                                                   |   |   |   | 0.01   | Mean                                                 |   |   |   | 1.539  |   |   |
| 916 | Maximum                                                                                                                   |   |   |   | 5.04   | Median                                               |   |   |   | 1.417  |   |   |
| 917 | SD                                                                                                                        |   |   |   | 1.194  | CV                                                   |   |   |   | 0.775  |   |   |
| 918 | k hat (MLE)                                                                                                               |   |   |   | 0.738  | k star (bias corrected MLE)                          |   |   |   | 0.726  |   |   |
| 919 | Theta hat (MLE)                                                                                                           |   |   |   | 2.086  | Theta star (bias corrected MLE)                      |   |   |   | 2.12   |   |   |
| 920 | nu hat (MLE)                                                                                                              |   |   |   | 190.4  | nu star (bias corrected)                             |   |   |   | 187.3  |   |   |
| 921 | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   |   | 0.0481 |                                                      |   |   |   |        |   |   |
| 922 | Approximate Chi Square Value (187.35, $\alpha$ )                                                                          |   |   |   | 156.7  | Adjusted Chi Square Value (187.35, $\beta$ )         |   |   |   | 156.4  |   |   |
| 923 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   |   | 1.841  | 95% Gamma Adjusted UCL (use when $n < 50$ )          |   |   |   | N/A    |   |   |
| 924 |                                                                                                                           |   |   |   |        |                                                      |   |   |   |        |   |   |
| 925 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |   |        |                                                      |   |   |   |        |   |   |
| 926 | Mean (KM)                                                                                                                 |   |   |   | 0.156  | SD (KM)                                              |   |   |   | 0.705  |   |   |
| 927 | Variance (KM)                                                                                                             |   |   |   | 0.497  | SE of Mean (KM)                                      |   |   |   | 0.076  |   |   |
| 928 | k hat (KM)                                                                                                                |   |   |   | 0.0487 | k star (KM)                                          |   |   |   | 0.0528 |   |   |
| 929 | nu hat (KM)                                                                                                               |   |   |   | 12.57  | nu star (KM)                                         |   |   |   | 13.61  |   |   |
| 930 | theta hat (KM)                                                                                                            |   |   |   | 3.193  | theta star (KM)                                      |   |   |   | 2.949  |   |   |
| 931 | 80% gamma percentile (KM)                                                                                                 |   |   |   | 0.0254 | 90% gamma percentile (KM)                            |   |   |   | 0.254  |   |   |
| 932 | 95% gamma percentile (KM)                                                                                                 |   |   |   | 0.843  | 99% gamma percentile (KM)                            |   |   |   | 3.312  |   |   |
| 933 |                                                                                                                           |   |   |   |        |                                                      |   |   |   |        |   |   |
| 934 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |   |        |                                                      |   |   |   |        |   |   |
| 935 | Approximate Chi Square Value (13.61, $\alpha$ )                                                                           |   |   |   | 6.308  | Adjusted Chi Square Value (13.61, $\beta$ )          |   |   |   | 6.251  |   |   |
| 936 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   |   |   | 0.336  | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )       |   |   |   | 0.339  |   |   |
| 937 |                                                                                                                           |   |   |   |        |                                                      |   |   |   |        |   |   |
| 938 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |   |        |                                                      |   |   |   |        |   |   |

| A    | B                                                                                                                                        | C | D | E      | F                                                       | G | H | I       | J | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|---------------------------------------------------------|---|---|---------|---|---|---|--|
| 939  | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.997  | <b>Shapiro Wilk GOF Test</b>                            |   |   |         |   |   |   |  |
| 940  | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.767  | Detected Data appear Lognormal at 5% Significance Level |   |   |         |   |   |   |  |
| 941  | Lilliefors Test Statistic                                                                                                                |   |   | 0.192  | <b>Lilliefors GOF Test</b>                              |   |   |         |   |   |   |  |
| 942  | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.425  | Detected Data appear Lognormal at 5% Significance Level |   |   |         |   |   |   |  |
| 943  | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                           |   |   |        |                                                         |   |   |         |   |   |   |  |
| 944  |                                                                                                                                          |   |   |        |                                                         |   |   |         |   |   |   |  |
| 945  | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |   |   |        |                                                         |   |   |         |   |   |   |  |
| 946  | Mean in Original Scale                                                                                                                   |   |   | 2.395  | Mean in Log Scale                                       |   |   | 0.828   |   |   |   |  |
| 947  | SD in Original Scale                                                                                                                     |   |   | 0.744  | SD in Log Scale                                         |   |   | 0.303   |   |   |   |  |
| 948  | 95% t UCL (assumes normality of ROS data)                                                                                                |   |   | 2.504  | 95% Percentile Bootstrap UCL                            |   |   | 2.505   |   |   |   |  |
| 949  | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 2.51   | 95% Bootstrap t UCL                                     |   |   | 2.507   |   |   |   |  |
| 950  | 95% H-UCL (Log ROS)                                                                                                                      |   |   | 2.509  |                                                         |   |   |         |   |   |   |  |
| 951  |                                                                                                                                          |   |   |        |                                                         |   |   |         |   |   |   |  |
| 952  | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |   |        |                                                         |   |   |         |   |   |   |  |
| 953  | KM Mean (logged)                                                                                                                         |   |   | -2.95  | KM Geo Mean                                             |   |   | 0.0523  |   |   |   |  |
| 954  | KM SD (logged)                                                                                                                           |   |   | 0.694  | 95% Critical H Value (KM-Log)                           |   |   | 1.947   |   |   |   |  |
| 955  | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.0749 | 95% H-UCL (KM -Log)                                     |   |   | 0.075   |   |   |   |  |
| 956  | KM SD (logged)                                                                                                                           |   |   | 0.694  | 95% Critical H Value (KM-Log)                           |   |   | 1.947   |   |   |   |  |
| 957  | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.0749 |                                                         |   |   |         |   |   |   |  |
| 958  |                                                                                                                                          |   |   |        |                                                         |   |   |         |   |   |   |  |
| 959  | <b>DL/2 Statistics</b>                                                                                                                   |   |   |        |                                                         |   |   |         |   |   |   |  |
| 960  | <b>DL/2 Normal</b>                                                                                                                       |   |   |        | <b>DL/2 Log-Transformed</b>                             |   |   |         |   |   |   |  |
| 961  | Mean in Original Scale                                                                                                                   |   |   | 1.245  | Mean in Log Scale                                       |   |   | -0.0233 |   |   |   |  |
| 962  | SD in Original Scale                                                                                                                     |   |   | 0.624  | SD in Log Scale                                         |   |   | 1.044   |   |   |   |  |
| 963  | 95% t UCL (Assumes normality)                                                                                                            |   |   | 1.336  | 95% H-Stat UCL                                          |   |   | 2.071   |   |   |   |  |
| 964  | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |   |        |                                                         |   |   |         |   |   |   |  |
| 965  |                                                                                                                                          |   |   |        |                                                         |   |   |         |   |   |   |  |
| 966  | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |                                                         |   |   |         |   |   |   |  |
| 967  | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                  |   |   |        |                                                         |   |   |         |   |   |   |  |
| 968  |                                                                                                                                          |   |   |        |                                                         |   |   |         |   |   |   |  |
| 969  | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                         |   |   |         |   |   |   |  |
| 970  | 95% KM (t) UCL                                                                                                                           |   |   | 0.282  |                                                         |   |   |         |   |   |   |  |
| 971  |                                                                                                                                          |   |   |        |                                                         |   |   |         |   |   |   |  |
| 972  | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                         |   |   |         |   |   |   |  |
| 973  | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                         |   |   |         |   |   |   |  |
| 974  | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                         |   |   |         |   |   |   |  |
| 975  | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                         |   |   |         |   |   |   |  |
| 976  |                                                                                                                                          |   |   |        |                                                         |   |   |         |   |   |   |  |
| 977  | <b>Result (eu7_arsenic)</b>                                                                                                              |   |   |        |                                                         |   |   |         |   |   |   |  |
| 978  |                                                                                                                                          |   |   |        |                                                         |   |   |         |   |   |   |  |
| 979  | <b>General Statistics</b>                                                                                                                |   |   |        |                                                         |   |   |         |   |   |   |  |
| 980  | Total Number of Observations                                                                                                             |   |   | 150    | Number of Distinct Observations                         |   |   | 13      |   |   |   |  |
| 981  | Number of Detects                                                                                                                        |   |   | 11     | Number of Non-Detects                                   |   |   | 139     |   |   |   |  |
| 982  | Number of Distinct Detects                                                                                                               |   |   | 11     | Number of Distinct Non-Detects                          |   |   | 2       |   |   |   |  |
| 983  | Minimum Detect                                                                                                                           |   |   | 0.1    | Minimum Non-Detect                                      |   |   | 0.026   |   |   |   |  |
| 984  | Maximum Detect                                                                                                                           |   |   | 6.9    | Maximum Non-Detect                                      |   |   | 2.5     |   |   |   |  |
| 985  | Variance Detects                                                                                                                         |   |   | 5.632  | Percent Non-Detects                                     |   |   | 92.67%  |   |   |   |  |
| 986  | Mean Detects                                                                                                                             |   |   | 2.947  | SD Detects                                              |   |   | 2.373   |   |   |   |  |
| 987  | Median Detects                                                                                                                           |   |   | 2.8    | CV Detects                                              |   |   | 0.805   |   |   |   |  |
| 988  | Skewness Detects                                                                                                                         |   |   | 0.486  | Kurtosis Detects                                        |   |   | -0.676  |   |   |   |  |
| 989  | Mean of Logged Detects                                                                                                                   |   |   | 0.495  | SD of Logged Detects                                    |   |   | 1.434   |   |   |   |  |
| 990  |                                                                                                                                          |   |   |        |                                                         |   |   |         |   |   |   |  |
| 991  | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |   |        |                                                         |   |   |         |   |   |   |  |
| 992  | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.913  | <b>Shapiro Wilk GOF Test</b>                            |   |   |         |   |   |   |  |
| 993  | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.85   | Detected Data appear Normal at 5% Significance Level    |   |   |         |   |   |   |  |
| 994  | Lilliefors Test Statistic                                                                                                                |   |   | 0.145  | <b>Lilliefors GOF Test</b>                              |   |   |         |   |   |   |  |
| 995  | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.251  | Detected Data appear Normal at 5% Significance Level    |   |   |         |   |   |   |  |
| 996  | <b>Detected Data appear Normal at 5% Significance Level</b>                                                                              |   |   |        |                                                         |   |   |         |   |   |   |  |
| 997  |                                                                                                                                          |   |   |        |                                                         |   |   |         |   |   |   |  |
| 998  | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |   |        |                                                         |   |   |         |   |   |   |  |
| 999  | KM Mean                                                                                                                                  |   |   | 0.491  | KM Standard Error of Mean                               |   |   | 0.167   |   |   |   |  |
| 1000 | KM SD                                                                                                                                    |   |   | 0.996  | 95% KM (BCA) UCL                                        |   |   | 0.804   |   |   |   |  |
| 1001 | 95% KM (t) UCL                                                                                                                           |   |   | 0.767  | 95% KM (Percentile Bootstrap) UCL                       |   |   | 0.786   |   |   |   |  |
| 1002 | 95% KM (z) UCL                                                                                                                           |   |   | 0.765  | 95% KM Bootstrap t UCL                                  |   |   | 0.989   |   |   |   |  |
| 1003 | 90% KM Chebyshev UCL                                                                                                                     |   |   | 0.991  | 95% KM Chebyshev UCL                                    |   |   | 1.218   |   |   |   |  |
| 1004 | 97.5% KM Chebyshev UCL                                                                                                                   |   |   | 1.533  | 99% KM Chebyshev UCL                                    |   |   | 2.151   |   |   |   |  |
| 1005 |                                                                                                                                          |   |   |        |                                                         |   |   |         |   |   |   |  |

|      | A                                                                                                                         | B | C | D      | E                                                               | F | G                           | H      | I | J | K | L |  |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|--------|-----------------------------------------------------------------|---|-----------------------------|--------|---|---|---|---|--|
| 1006 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1007 | A-D Test Statistic                                                                                                        |   |   | 0.465  | <b>Anderson-Darling GOF Test</b>                                |   |                             |        |   |   |   |   |  |
| 1008 | 5% A-D Critical Value                                                                                                     |   |   | 0.752  | Detected data appear Gamma Distributed at 5% Significance Level |   |                             |        |   |   |   |   |  |
| 1009 | K-S Test Statistic                                                                                                        |   |   | 0.229  | <b>Kolmogorov-Smirnov GOF</b>                                   |   |                             |        |   |   |   |   |  |
| 1010 | 5% K-S Critical Value                                                                                                     |   |   | 0.263  | Detected data appear Gamma Distributed at 5% Significance Level |   |                             |        |   |   |   |   |  |
| 1011 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                    |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1012 |                                                                                                                           |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1013 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1014 | k hat (MLE)                                                                                                               |   |   | 0.986  | k star (bias corrected MLE)                                     |   |                             | 0.778  |   |   |   |   |  |
| 1015 | Theta hat (MLE)                                                                                                           |   |   | 2.988  | Theta star (bias corrected MLE)                                 |   |                             | 3.789  |   |   |   |   |  |
| 1016 | nu hat (MLE)                                                                                                              |   |   | 21.7   | nu star (bias corrected)                                        |   |                             | 17.11  |   |   |   |   |  |
| 1017 | Mean (detects)                                                                                                            |   |   | 2.947  |                                                                 |   |                             |        |   |   |   |   |  |
| 1018 |                                                                                                                           |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1019 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1020 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1021 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1022 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1023 | This is especially true when the sample size is small.                                                                    |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1024 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1025 | Minimum                                                                                                                   |   |   | 0.01   | Mean                                                            |   |                             | 0.532  |   |   |   |   |  |
| 1026 | Maximum                                                                                                                   |   |   | 6.9    | Median                                                          |   |                             | 0.01   |   |   |   |   |  |
| 1027 | SD                                                                                                                        |   |   | 1.117  | CV                                                              |   |                             | 2.098  |   |   |   |   |  |
| 1028 | k hat (MLE)                                                                                                               |   |   | 0.294  | k star (bias corrected MLE)                                     |   |                             | 0.293  |   |   |   |   |  |
| 1029 | Theta hat (MLE)                                                                                                           |   |   | 1.81   | Theta star (bias corrected MLE)                                 |   |                             | 1.819  |   |   |   |   |  |
| 1030 | nu hat (MLE)                                                                                                              |   |   | 88.24  | nu star (bias corrected)                                        |   |                             | 87.81  |   |   |   |   |  |
| 1031 | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   | 0.0484 |                                                                 |   |                             |        |   |   |   |   |  |
| 1032 | Approximate Chi Square Value (87.81, $\alpha$ )                                                                           |   |   | 67.2   | Adjusted Chi Square Value (87.81, $\beta$ )                     |   |                             | 67.03  |   |   |   |   |  |
| 1033 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   | 0.696  | 95% Gamma Adjusted UCL (use when $n < 50$ )                     |   |                             | 0.697  |   |   |   |   |  |
| 1034 |                                                                                                                           |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1035 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1036 | Mean (KM)                                                                                                                 |   |   | 0.491  | SD (KM)                                                         |   |                             | 0.996  |   |   |   |   |  |
| 1037 | Variance (KM)                                                                                                             |   |   | 0.992  | SE of Mean (KM)                                                 |   |                             | 0.167  |   |   |   |   |  |
| 1038 | k hat (KM)                                                                                                                |   |   | 0.243  | k star (KM)                                                     |   |                             | 0.243  |   |   |   |   |  |
| 1039 | nu hat (KM)                                                                                                               |   |   | 72.93  | nu star (KM)                                                    |   |                             | 72.81  |   |   |   |   |  |
| 1040 | theta hat (KM)                                                                                                            |   |   | 2.02   | theta star (KM)                                                 |   |                             | 2.023  |   |   |   |   |  |
| 1041 | 80% gamma percentile (KM)                                                                                                 |   |   | 0.705  | 90% gamma percentile (KM)                                       |   |                             | 1.477  |   |   |   |   |  |
| 1042 | 95% gamma percentile (KM)                                                                                                 |   |   | 2.398  | 99% gamma percentile (KM)                                       |   |                             | 4.859  |   |   |   |   |  |
| 1043 |                                                                                                                           |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1044 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1045 | Approximate Chi Square Value (72.81, $\alpha$ )                                                                           |   |   | 54.16  | Adjusted Chi Square Value (72.81, $\beta$ )                     |   |                             | 54     |   |   |   |   |  |
| 1046 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   |   | 0.66   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )                  |   |                             | 0.662  |   |   |   |   |  |
| 1047 |                                                                                                                           |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1048 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1049 | Shapiro Wilk Test Statistic                                                                                               |   |   | 0.854  | <b>Shapiro Wilk GOF Test</b>                                    |   |                             |        |   |   |   |   |  |
| 1050 | 5% Shapiro Wilk Critical Value                                                                                            |   |   | 0.85   | Detected Data appear Lognormal at 5% Significance Level         |   |                             |        |   |   |   |   |  |
| 1051 | Lilliefors Test Statistic                                                                                                 |   |   | 0.266  | <b>Lilliefors GOF Test</b>                                      |   |                             |        |   |   |   |   |  |
| 1052 | 5% Lilliefors Critical Value                                                                                              |   |   | 0.251  | Detected Data Not Lognormal at 5% Significance Level            |   |                             |        |   |   |   |   |  |
| 1053 | <b>Detected Data appear Approximate Lognormal at 5% Significance Level</b>                                                |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1054 |                                                                                                                           |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1055 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1056 | Mean in Original Scale                                                                                                    |   |   | 0.476  | Mean in Log Scale                                               |   |                             | -1.987 |   |   |   |   |  |
| 1057 | SD in Original Scale                                                                                                      |   |   | 1.003  | SD in Log Scale                                                 |   |                             | 1.631  |   |   |   |   |  |
| 1058 | 95% t UCL (assumes normality of ROS data)                                                                                 |   |   | 0.611  | 95% Percentile Bootstrap UCL                                    |   |                             | 0.623  |   |   |   |   |  |
| 1059 | 95% BCA Bootstrap UCL                                                                                                     |   |   | 0.648  | 95% Bootstrap t UCL                                             |   |                             | 0.672  |   |   |   |   |  |
| 1060 | 95% H-UCL (Log ROS)                                                                                                       |   |   | 0.76   |                                                                 |   |                             |        |   |   |   |   |  |
| 1061 |                                                                                                                           |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1062 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1063 | KM Mean (logged)                                                                                                          |   |   | -2.022 | KM Geo Mean                                                     |   |                             | 0.132  |   |   |   |   |  |
| 1064 | KM SD (logged)                                                                                                            |   |   | 1.62   | 95% Critical H Value (KM-Log)                                   |   |                             | 2.846  |   |   |   |   |  |
| 1065 | KM Standard Error of Mean (logged)                                                                                        |   |   | 0.557  | 95% H-UCL (KM -Log)                                             |   |                             | 0.717  |   |   |   |   |  |
| 1066 | KM SD (logged)                                                                                                            |   |   | 1.62   | 95% Critical H Value (KM-Log)                                   |   |                             | 2.846  |   |   |   |   |  |
| 1067 | KM Standard Error of Mean (logged)                                                                                        |   |   | 0.557  |                                                                 |   |                             |        |   |   |   |   |  |
| 1068 |                                                                                                                           |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1069 | <b>DL/2 Statistics</b>                                                                                                    |   |   |        |                                                                 |   |                             |        |   |   |   |   |  |
| 1070 | <b>DL/2 Normal</b>                                                                                                        |   |   |        |                                                                 |   | <b>DL/2 Log-Transformed</b> |        |   |   |   |   |  |
| 1071 | Mean in Original Scale                                                                                                    |   |   | 1.35   | Mean in Log Scale                                               |   |                             | 0.152  |   |   |   |   |  |
| 1072 | SD in Original Scale                                                                                                      |   |   | 0.782  | SD in Log Scale                                                 |   |                             | 0.747  |   |   |   |   |  |

| A    | B                                                                                                                                        | C                              | D | E     | F | G                                                    | H | I | J | K | L     |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|---|-------|---|------------------------------------------------------|---|---|---|---|-------|
| 1073 |                                                                                                                                          | 95% t UCL (Assumes normality)  |   | 1.455 |   | 95% H-Stat UCL                                       |   |   |   |   | 1.738 |
| 1074 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |                                |   |       |   |                                                      |   |   |   |   |       |
| 1075 |                                                                                                                                          |                                |   |       |   |                                                      |   |   |   |   |       |
| 1076 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |                                |   |       |   |                                                      |   |   |   |   |       |
| 1077 | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                  |                                |   |       |   |                                                      |   |   |   |   |       |
| 1078 |                                                                                                                                          |                                |   |       |   |                                                      |   |   |   |   |       |
| 1079 | <b>Suggested UCL to Use</b>                                                                                                              |                                |   |       |   |                                                      |   |   |   |   |       |
| 1080 |                                                                                                                                          | 95% KM (t) UCL                 |   | 0.767 |   |                                                      |   |   |   |   |       |
| 1081 |                                                                                                                                          |                                |   |       |   |                                                      |   |   |   |   |       |
| 1082 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |                                |   |       |   |                                                      |   |   |   |   |       |
| 1083 | Recommendations are based upon data size, data distribution, and skewness.                                                               |                                |   |       |   |                                                      |   |   |   |   |       |
| 1084 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |                                |   |       |   |                                                      |   |   |   |   |       |
| 1085 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |                                |   |       |   |                                                      |   |   |   |   |       |
| 1086 |                                                                                                                                          |                                |   |       |   |                                                      |   |   |   |   |       |
| 1087 | <b>Result (eu7_beryllium)</b>                                                                                                            |                                |   |       |   |                                                      |   |   |   |   |       |
| 1088 |                                                                                                                                          |                                |   |       |   |                                                      |   |   |   |   |       |
| 1089 | <b>General Statistics</b>                                                                                                                |                                |   |       |   |                                                      |   |   |   |   |       |
| 1090 |                                                                                                                                          | Total Number of Observations   |   | 150   |   | Number of Distinct Observations                      |   |   |   |   | 5     |
| 1091 |                                                                                                                                          | Number of Detects              |   | 3     |   | Number of Non-Detects                                |   |   |   |   | 147   |
| 1092 |                                                                                                                                          | Number of Distinct Detects     |   | 3     |   | Number of Distinct Non-Detects                       |   |   |   |   | 2     |
| 1093 |                                                                                                                                          | Minimum Detect                 |   | 1.1   |   | Minimum Non-Detect                                   |   |   |   |   | 0.043 |
| 1094 |                                                                                                                                          | Maximum Detect                 |   | 4.63  |   | Maximum Non-Detect                                   |   |   |   |   | 2     |
| 1095 |                                                                                                                                          | Variance Detects               |   | 4.039 |   | Percent Non-Detects                                  |   |   |   |   | 98%   |
| 1096 |                                                                                                                                          | Mean Detects                   |   | 2.31  |   | SD Detects                                           |   |   |   |   | 2.01  |
| 1097 |                                                                                                                                          | Median Detects                 |   | 1.2   |   | CV Detects                                           |   |   |   |   | 0.87  |
| 1098 |                                                                                                                                          | Skewness Detects               |   | 1.727 |   | Kurtosis Detects                                     |   |   |   |   | N/A   |
| 1099 |                                                                                                                                          | Mean of Logged Detects         |   | 0.603 |   | SD of Logged Detects                                 |   |   |   |   | 0.806 |
| 1100 |                                                                                                                                          |                                |   |       |   |                                                      |   |   |   |   |       |
| 1101 | <b>Warning: Data set has only 3 Detected Values.</b>                                                                                     |                                |   |       |   |                                                      |   |   |   |   |       |
| 1102 | <b>This is not enough to compute meaningful or reliable statistics and estimates.</b>                                                    |                                |   |       |   |                                                      |   |   |   |   |       |
| 1103 |                                                                                                                                          |                                |   |       |   |                                                      |   |   |   |   |       |
| 1104 |                                                                                                                                          |                                |   |       |   |                                                      |   |   |   |   |       |
| 1105 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |                                |   |       |   |                                                      |   |   |   |   |       |
| 1106 |                                                                                                                                          | Shapiro Wilk Test Statistic    |   | 0.771 |   | <b>Shapiro Wilk GOF Test</b>                         |   |   |   |   |       |
| 1107 |                                                                                                                                          | 5% Shapiro Wilk Critical Value |   | 0.767 |   | Detected Data appear Normal at 5% Significance Level |   |   |   |   |       |
| 1108 |                                                                                                                                          | Lilliefors Test Statistic      |   | 0.376 |   | <b>Lilliefors GOF Test</b>                           |   |   |   |   |       |
| 1109 |                                                                                                                                          | 5% Lilliefors Critical Value   |   | 0.425 |   | Detected Data appear Normal at 5% Significance Level |   |   |   |   |       |
| 1110 | <b>Detected Data appear Normal at 5% Significance Level</b>                                                                              |                                |   |       |   |                                                      |   |   |   |   |       |
| 1111 |                                                                                                                                          |                                |   |       |   |                                                      |   |   |   |   |       |
| 1112 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |                                |   |       |   |                                                      |   |   |   |   |       |
| 1113 |                                                                                                                                          | KM Mean                        |   | 0.318 |   | KM Standard Error of Mean                            |   |   |   |   | 0.19  |
| 1114 |                                                                                                                                          | KM SD                          |   | 0.579 |   | 95% KM (BCA) UCL                                     |   |   |   |   | N/A   |
| 1115 |                                                                                                                                          | 95% KM (t) UCL                 |   | 0.633 |   | 95% KM (Percentile Bootstrap) UCL                    |   |   |   |   | N/A   |
| 1116 |                                                                                                                                          | 95% KM (z) UCL                 |   | 0.631 |   | 95% KM Bootstrap t UCL                               |   |   |   |   | N/A   |
| 1117 |                                                                                                                                          | 90% KM Chebyshev UCL           |   | 0.889 |   | 95% KM Chebyshev UCL                                 |   |   |   |   | 1.147 |
| 1118 |                                                                                                                                          | 97.5% KM Chebyshev UCL         |   | 1.506 |   | 99% KM Chebyshev UCL                                 |   |   |   |   | 2.21  |
| 1119 |                                                                                                                                          |                                |   |       |   |                                                      |   |   |   |   |       |
| 1120 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |                                |   |       |   |                                                      |   |   |   |   |       |
| 1121 | <b>Not Enough Data to Perform GOF Test</b>                                                                                               |                                |   |       |   |                                                      |   |   |   |   |       |
| 1122 |                                                                                                                                          |                                |   |       |   |                                                      |   |   |   |   |       |
| 1123 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |                                |   |       |   |                                                      |   |   |   |   |       |
| 1124 |                                                                                                                                          | k hat (MLE)                    |   | 2.291 |   | k star (bias corrected MLE)                          |   |   |   |   | N/A   |
| 1125 |                                                                                                                                          | Theta hat (MLE)                |   | 1.008 |   | Theta star (bias corrected MLE)                      |   |   |   |   | N/A   |
| 1126 |                                                                                                                                          | nu hat (MLE)                   |   | 13.75 |   | nu star (bias corrected)                             |   |   |   |   | N/A   |
| 1127 |                                                                                                                                          | Mean (detects)                 |   | 2.31  |   |                                                      |   |   |   |   |       |
| 1128 |                                                                                                                                          |                                |   |       |   |                                                      |   |   |   |   |       |
| 1129 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |                                |   |       |   |                                                      |   |   |   |   |       |
| 1130 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |                                |   |       |   |                                                      |   |   |   |   |       |
| 1131 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |                                |   |       |   |                                                      |   |   |   |   |       |
| 1132 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |                                |   |       |   |                                                      |   |   |   |   |       |
| 1133 | This is especially true when the sample size is small.                                                                                   |                                |   |       |   |                                                      |   |   |   |   |       |
| 1134 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |                                |   |       |   |                                                      |   |   |   |   |       |
| 1135 |                                                                                                                                          | Minimum                        |   | 0.01  |   | Mean                                                 |   |   |   |   | 0.339 |
| 1136 |                                                                                                                                          | Maximum                        |   | 4.63  |   | Median                                               |   |   |   |   | 0.01  |
| 1137 |                                                                                                                                          | SD                             |   | 0.72  |   | CV                                                   |   |   |   |   | 2.122 |
| 1138 |                                                                                                                                          | k hat (MLE)                    |   | 0.31  |   | k star (bias corrected MLE)                          |   |   |   |   | 0.308 |
| 1139 |                                                                                                                                          | Theta hat (MLE)                |   | 1.095 |   | Theta star (bias corrected MLE)                      |   |   |   |   | 1.101 |

|      | A | B | C | D                                                                                                                                         | E | F      | G                           | H | I | J                                                       | K                        | L      |
|------|---|---|---|-------------------------------------------------------------------------------------------------------------------------------------------|---|--------|-----------------------------|---|---|---------------------------------------------------------|--------------------------|--------|
| 1140 |   |   |   | nu hat (MLE)                                                                                                                              |   | 92.97  |                             |   |   |                                                         | nu star (bias corrected) | 92.45  |
| 1141 |   |   |   | Adjusted Level of Significance ( $\beta$ )                                                                                                |   | 0.0484 |                             |   |   |                                                         |                          |        |
| 1142 |   |   |   | Approximate Chi Square Value (92.45, $\alpha$ )                                                                                           |   | 71.27  |                             |   |   | Adjusted Chi Square Value (92.45, $\beta$ )             |                          | 71.09  |
| 1143 |   |   |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                                         |   | 0.44   |                             |   |   | 95% Gamma Adjusted UCL (use when $n < 50$ )             |                          | N/A    |
| 1144 |   |   |   | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                   |   |        |                             |   |   |                                                         |                          |        |
| 1145 |   |   |   | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                   |   |        |                             |   |   |                                                         |                          |        |
| 1146 |   |   |   | Mean (KM)                                                                                                                                 |   | 0.318  |                             |   |   | SD (KM)                                                 |                          | 0.579  |
| 1147 |   |   |   | Variance (KM)                                                                                                                             |   | 0.336  |                             |   |   | SE of Mean (KM)                                         |                          | 0.19   |
| 1148 |   |   |   | k hat (KM)                                                                                                                                |   | 0.301  |                             |   |   | k star (KM)                                             |                          | 0.3    |
| 1149 |   |   |   | nu hat (KM)                                                                                                                               |   | 90.33  |                             |   |   | nu star (KM)                                            |                          | 89.85  |
| 1150 |   |   |   | theta hat (KM)                                                                                                                            |   | 1.056  |                             |   |   | theta star (KM)                                         |                          | 1.062  |
| 1151 |   |   |   | 80% gamma percentile (KM)                                                                                                                 |   | 0.487  |                             |   |   | 90% gamma percentile (KM)                               |                          | 0.938  |
| 1152 |   |   |   | 95% gamma percentile (KM)                                                                                                                 |   | 1.455  |                             |   |   | 99% gamma percentile (KM)                               |                          | 2.8    |
| 1153 |   |   |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                 |   |        |                             |   |   |                                                         |                          |        |
| 1154 |   |   |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                 |   |        |                             |   |   |                                                         |                          |        |
| 1155 |   |   |   | Approximate Chi Square Value (89.85, $\alpha$ )                                                                                           |   | 69     |                             |   |   | Adjusted Chi Square Value (89.85, $\beta$ )             |                          | 68.82  |
| 1156 |   |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                       |   | 0.414  |                             |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )          |                          | 0.415  |
| 1157 |   |   |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                   |   |        |                             |   |   |                                                         |                          |        |
| 1158 |   |   |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                   |   |        |                             |   |   |                                                         |                          |        |
| 1159 |   |   |   | Shapiro Wilk Test Statistic                                                                                                               |   | 0.795  |                             |   |   | <b>Shapiro Wilk GOF Test</b>                            |                          |        |
| 1160 |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                            |   | 0.767  |                             |   |   | Detected Data appear Lognormal at 5% Significance Level |                          |        |
| 1161 |   |   |   | Lilliefors Test Statistic                                                                                                                 |   | 0.366  |                             |   |   | <b>Lilliefors GOF Test</b>                              |                          |        |
| 1162 |   |   |   | 5% Lilliefors Critical Value                                                                                                              |   | 0.425  |                             |   |   | Detected Data appear Lognormal at 5% Significance Level |                          |        |
| 1163 |   |   |   | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                            |   |        |                             |   |   |                                                         |                          |        |
| 1164 |   |   |   | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                            |   |        |                             |   |   |                                                         |                          |        |
| 1165 |   |   |   | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                 |   |        |                             |   |   |                                                         |                          |        |
| 1166 |   |   |   | Mean in Original Scale                                                                                                                    |   | 0.576  |                             |   |   | Mean in Log Scale                                       |                          | -0.928 |
| 1167 |   |   |   | SD in Original Scale                                                                                                                      |   | 0.592  |                             |   |   | SD in Log Scale                                         |                          | 0.869  |
| 1168 |   |   |   | 95% t UCL (assumes normality of ROS data)                                                                                                 |   | 0.656  |                             |   |   | 95% Percentile Bootstrap UCL                            |                          | 0.659  |
| 1169 |   |   |   | 95% BCA Bootstrap UCL                                                                                                                     |   | 0.672  |                             |   |   | 95% Bootstrap t UCL                                     |                          | 0.684  |
| 1170 |   |   |   | 95% H-UCL (Log ROS)                                                                                                                       |   | 0.67   |                             |   |   |                                                         |                          |        |
| 1171 |   |   |   | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                   |   |        |                             |   |   |                                                         |                          |        |
| 1172 |   |   |   | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                   |   |        |                             |   |   |                                                         |                          |        |
| 1173 |   |   |   | KM Mean (logged)                                                                                                                          |   | -2.39  |                             |   |   | KM Geo Mean                                             |                          | 0.0916 |
| 1174 |   |   |   | KM SD (logged)                                                                                                                            |   | 1.399  |                             |   |   | 95% Critical H Value (KM-Log)                           |                          | 2.602  |
| 1175 |   |   |   | KM Standard Error of Mean (logged)                                                                                                        |   | 0.555  |                             |   |   | 95% H-UCL (KM -Log)                                     |                          | 0.328  |
| 1176 |   |   |   | KM SD (logged)                                                                                                                            |   | 1.399  |                             |   |   | 95% Critical H Value (KM-Log)                           |                          | 2.602  |
| 1177 |   |   |   | KM Standard Error of Mean (logged)                                                                                                        |   | 0.555  |                             |   |   |                                                         |                          |        |
| 1178 |   |   |   | <b>DL/2 Statistics</b>                                                                                                                    |   |        |                             |   |   |                                                         |                          |        |
| 1179 |   |   |   | <b>DL/2 Statistics</b>                                                                                                                    |   |        |                             |   |   |                                                         |                          |        |
| 1180 |   |   |   | <b>DL/2 Normal</b>                                                                                                                        |   |        | <b>DL/2 Log-Transformed</b> |   |   |                                                         |                          |        |
| 1181 |   |   |   | Mean in Original Scale                                                                                                                    |   | 0.981  |                             |   |   | Mean in Log Scale                                       |                          | -0.167 |
| 1182 |   |   |   | SD in Original Scale                                                                                                                      |   | 0.365  |                             |   |   | SD in Log Scale                                         |                          | 0.825  |
| 1183 |   |   |   | 95% t UCL (Assumes normality)                                                                                                             |   | 1.03   |                             |   |   | 95% H-Stat UCL                                          |                          | 1.366  |
| 1184 |   |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                  |   |        |                             |   |   |                                                         |                          |        |
| 1185 |   |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                  |   |        |                             |   |   |                                                         |                          |        |
| 1186 |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                     |   |        |                             |   |   |                                                         |                          |        |
| 1187 |   |   |   | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                   |   |        |                             |   |   |                                                         |                          |        |
| 1188 |   |   |   | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                   |   |        |                             |   |   |                                                         |                          |        |
| 1189 |   |   |   | <b>Suggested UCL to Use</b>                                                                                                               |   |        |                             |   |   |                                                         |                          |        |
| 1190 |   |   |   | 95% KM (t) UCL                                                                                                                            |   | 0.633  |                             |   |   |                                                         |                          |        |
| 1191 |   |   |   | <b>Suggested UCL to Use</b>                                                                                                               |   |        |                             |   |   |                                                         |                          |        |
| 1192 |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |   |        |                             |   |   |                                                         |                          |        |
| 1193 |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                                |   |        |                             |   |   |                                                         |                          |        |
| 1194 |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |   |        |                             |   |   |                                                         |                          |        |
| 1195 |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |   |        |                             |   |   |                                                         |                          |        |
| 1196 |   |   |   | <b>Result (eu7_cadmium)</b>                                                                                                               |   |        |                             |   |   |                                                         |                          |        |
| 1197 |   |   |   | <b>Result (eu7_cadmium)</b>                                                                                                               |   |        |                             |   |   |                                                         |                          |        |
| 1198 |   |   |   | <b>Result (eu7_cadmium)</b>                                                                                                               |   |        |                             |   |   |                                                         |                          |        |
| 1199 |   |   |   | <b>General Statistics</b>                                                                                                                 |   |        |                             |   |   |                                                         |                          |        |
| 1200 |   |   |   | Total Number of Observations                                                                                                              |   | 152    |                             |   |   | Number of Distinct Observations                         |                          | 102    |
| 1201 |   |   |   | Number of Detects                                                                                                                         |   | 119    |                             |   |   | Number of Non-Detects                                   |                          | 33     |
| 1202 |   |   |   | Number of Distinct Detects                                                                                                                |   | 100    |                             |   |   | Number of Distinct Non-Detects                          |                          | 2      |
| 1203 |   |   |   | Minimum Detect                                                                                                                            |   | 0.33   |                             |   |   | Minimum Non-Detect                                      |                          | 0.05   |
| 1204 |   |   |   | Maximum Detect                                                                                                                            |   | 62.4   |                             |   |   | Maximum Non-Detect                                      |                          | 0.5    |
| 1205 |   |   |   | Variance Detects                                                                                                                          |   | 73.42  |                             |   |   | Percent Non-Detects                                     |                          | 21.71% |
| 1206 |   |   |   | Mean Detects                                                                                                                              |   | 2.683  |                             |   |   | SD Detects                                              |                          | 8.569  |

|      | A                                                                                                                         | B | C | D                                                   | E | F      | G | H | I | J | K                                                            | L      |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|-----------------------------------------------------|---|--------|---|---|---|---|--------------------------------------------------------------|--------|
| 1207 |                                                                                                                           |   |   | Median Detects                                      |   | 0.926  |   |   |   |   | CV Detects                                                   | 3.193  |
| 1208 |                                                                                                                           |   |   | Skewness Detects                                    |   | 5.539  |   |   |   |   | Kurtosis Detects                                             | 30.98  |
| 1209 |                                                                                                                           |   |   | Mean of Logged Detects                              |   | 0.106  |   |   |   |   | SD of Logged Detects                                         | 0.847  |
| 1210 |                                                                                                                           |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1211 | <b>Normal GOF Test on Detects Only</b>                                                                                    |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1212 |                                                                                                                           |   |   | Shapiro Wilk Test Statistic                         |   | 0.253  |   |   |   |   | <b>Normal GOF Test on Detected Observations Only</b>         |        |
| 1213 |                                                                                                                           |   |   | 5% Shapiro Wilk P Value                             |   | 0      |   |   |   |   | Detected Data Not Normal at 5% Significance Level            |        |
| 1214 |                                                                                                                           |   |   | Lilliefors Test Statistic                           |   | 0.431  |   |   |   |   | <b>Lilliefors GOF Test</b>                                   |        |
| 1215 |                                                                                                                           |   |   | 5% Lilliefors Critical Value                        |   | 0.0816 |   |   |   |   | Detected Data Not Normal at 5% Significance Level            |        |
| 1216 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                  |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1217 |                                                                                                                           |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1218 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1219 |                                                                                                                           |   |   | KM Mean                                             |   | 2.122  |   |   |   |   | KM Standard Error of Mean                                    | 0.621  |
| 1220 |                                                                                                                           |   |   | KM SD                                               |   | 7.625  |   |   |   |   | 95% KM (BCA) UCL                                             | 3.372  |
| 1221 |                                                                                                                           |   |   | 95% KM (t) UCL                                      |   | 3.15   |   |   |   |   | 95% KM (Percentile Bootstrap) UCL                            | 3.151  |
| 1222 |                                                                                                                           |   |   | 95% KM (z) UCL                                      |   | 3.144  |   |   |   |   | 95% KM Bootstrap t UCL                                       | 4.073  |
| 1223 |                                                                                                                           |   |   | 90% KM Chebyshev UCL                                |   | 3.986  |   |   |   |   | 95% KM Chebyshev UCL                                         | 4.83   |
| 1224 |                                                                                                                           |   |   | 97.5% KM Chebyshev UCL                              |   | 6.002  |   |   |   |   | 99% KM Chebyshev UCL                                         | 8.303  |
| 1225 |                                                                                                                           |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1226 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1227 |                                                                                                                           |   |   | A-D Test Statistic                                  |   | 24.39  |   |   |   |   | <b>Anderson-Darling GOF Test</b>                             |        |
| 1228 |                                                                                                                           |   |   | 5% A-D Critical Value                               |   | 0.801  |   |   |   |   | Detected Data Not Gamma Distributed at 5% Significance Level |        |
| 1229 |                                                                                                                           |   |   | K-S Test Statistic                                  |   | 0.373  |   |   |   |   | <b>Kolmogorov-Smirnov GOF</b>                                |        |
| 1230 |                                                                                                                           |   |   | 5% K-S Critical Value                               |   | 0.0883 |   |   |   |   | Detected Data Not Gamma Distributed at 5% Significance Level |        |
| 1231 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                       |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1232 |                                                                                                                           |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1233 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1234 |                                                                                                                           |   |   | k hat (MLE)                                         |   | 0.687  |   |   |   |   | k star (bias corrected MLE)                                  | 0.676  |
| 1235 |                                                                                                                           |   |   | Theta hat (MLE)                                     |   | 3.904  |   |   |   |   | Theta star (bias corrected MLE)                              | 3.971  |
| 1236 |                                                                                                                           |   |   | nu hat (MLE)                                        |   | 163.6  |   |   |   |   | nu star (bias corrected)                                     | 160.8  |
| 1237 |                                                                                                                           |   |   | Mean (detects)                                      |   | 2.683  |   |   |   |   |                                                              |        |
| 1238 |                                                                                                                           |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1239 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1240 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1241 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1242 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1243 | This is especially true when the sample size is small.                                                                    |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1244 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1245 |                                                                                                                           |   |   | Minimum                                             |   | 0.01   |   |   |   |   | Mean                                                         | 2.103  |
| 1246 |                                                                                                                           |   |   | Maximum                                             |   | 62.4   |   |   |   |   | Median                                                       | 0.815  |
| 1247 |                                                                                                                           |   |   | SD                                                  |   | 7.655  |   |   |   |   | CV                                                           | 3.64   |
| 1248 |                                                                                                                           |   |   | k hat (MLE)                                         |   | 0.397  |   |   |   |   | k star (bias corrected MLE)                                  | 0.393  |
| 1249 |                                                                                                                           |   |   | Theta hat (MLE)                                     |   | 5.3    |   |   |   |   | Theta star (bias corrected MLE)                              | 5.346  |
| 1250 |                                                                                                                           |   |   | nu hat (MLE)                                        |   | 120.6  |   |   |   |   | nu star (bias corrected)                                     | 119.6  |
| 1251 |                                                                                                                           |   |   | Adjusted Level of Significance ( $\beta$ )          |   | 0.0484 |   |   |   |   |                                                              |        |
| 1252 |                                                                                                                           |   |   | Approximate Chi Square Value (119.59, $\alpha$ )    |   | 95.33  |   |   |   |   | Adjusted Chi Square Value (119.59, $\beta$ )                 | 95.13  |
| 1253 |                                                                                                                           |   |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )   |   | 2.638  |   |   |   |   | 95% Gamma Adjusted UCL (use when $n < 50$ )                  | 2.644  |
| 1254 |                                                                                                                           |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1255 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1256 |                                                                                                                           |   |   | Mean (KM)                                           |   | 2.122  |   |   |   |   | SD (KM)                                                      | 7.625  |
| 1257 |                                                                                                                           |   |   | Variance (KM)                                       |   | 58.14  |   |   |   |   | SE of Mean (KM)                                              | 0.621  |
| 1258 |                                                                                                                           |   |   | k hat (KM)                                          |   | 0.0775 |   |   |   |   | k star (KM)                                                  | 0.0803 |
| 1259 |                                                                                                                           |   |   | nu hat (KM)                                         |   | 23.56  |   |   |   |   | nu star (KM)                                                 | 24.42  |
| 1260 |                                                                                                                           |   |   | theta hat (KM)                                      |   | 27.39  |   |   |   |   | theta star (KM)                                              | 26.42  |
| 1261 |                                                                                                                           |   |   | 80% gamma percentile (KM)                           |   | 1.019  |   |   |   |   | 90% gamma percentile (KM)                                    | 5.046  |
| 1262 |                                                                                                                           |   |   | 95% gamma percentile (KM)                           |   | 12.34  |   |   |   |   | 99% gamma percentile (KM)                                    | 37.51  |
| 1263 |                                                                                                                           |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1264 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1265 |                                                                                                                           |   |   | Approximate Chi Square Value (24.42, $\alpha$ )     |   | 14.17  |   |   |   |   | Adjusted Chi Square Value (24.42, $\beta$ )                  | 14.1   |
| 1266 |                                                                                                                           |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ ) |   | 3.658  |   |   |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )               | 3.677  |
| 1267 |                                                                                                                           |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1268 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |                                                     |   |        |   |   |   |   |                                                              |        |
| 1269 |                                                                                                                           |   |   | Shapiro Wilk Approximate Test Statistic             |   | 0.677  |   |   |   |   | <b>Shapiro Wilk GOF Test</b>                                 |        |
| 1270 |                                                                                                                           |   |   | 5% Shapiro Wilk P Value                             |   | 0      |   |   |   |   | Detected Data Not Lognormal at 5% Significance Level         |        |
| 1271 |                                                                                                                           |   |   | Lilliefors Test Statistic                           |   | 0.243  |   |   |   |   | <b>Lilliefors GOF Test</b>                                   |        |
| 1272 |                                                                                                                           |   |   | 5% Lilliefors Critical Value                        |   | 0.0816 |   |   |   |   | Detected Data Not Lognormal at 5% Significance Level         |        |
| 1273 | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                               |   |   |                                                     |   |        |   |   |   |   |                                                              |        |

| A    | B                                                                                                                                        | C | D      | E | F | G                                                    | H | I | J | K      | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|---|---|------------------------------------------------------|---|---|---|--------|---|
| 1274 |                                                                                                                                          |   |        |   |   |                                                      |   |   |   |        |   |
| 1275 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |   |        |   |   |                                                      |   |   |   |        |   |
| 1276 | Mean in Original Scale                                                                                                                   |   | 2.15   |   |   | Mean in Log Scale                                    |   |   |   | -0.258 |   |
| 1277 | SD in Original Scale                                                                                                                     |   | 7.643  |   |   | SD in Log Scale                                      |   |   |   | 1.038  |   |
| 1278 | 95% t UCL (assumes normality of ROS data)                                                                                                |   | 3.176  |   |   | 95% Percentile Bootstrap UCL                         |   |   |   | 3.227  |   |
| 1279 | 95% BCA Bootstrap UCL                                                                                                                    |   | 3.673  |   |   | 95% Bootstrap t UCL                                  |   |   |   | 4.293  |   |
| 1280 | 95% H-UCL (Log ROS)                                                                                                                      |   | 1.6    |   |   |                                                      |   |   |   |        |   |
| 1281 |                                                                                                                                          |   |        |   |   |                                                      |   |   |   |        |   |
| 1282 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |        |   |   |                                                      |   |   |   |        |   |
| 1283 | KM Mean (logged)                                                                                                                         |   | -0.496 |   |   | KM Geo Mean                                          |   |   |   | 0.609  |   |
| 1284 | KM SD (logged)                                                                                                                           |   | 1.405  |   |   | 95% Critical H Value (KM-Log)                        |   |   |   | 2.61   |   |
| 1285 | KM Standard Error of Mean (logged)                                                                                                       |   | 0.134  |   |   | 95% H-UCL (KM -Log)                                  |   |   |   | 2.202  |   |
| 1286 | KM SD (logged)                                                                                                                           |   | 1.405  |   |   | 95% Critical H Value (KM-Log)                        |   |   |   | 2.61   |   |
| 1287 | KM Standard Error of Mean (logged)                                                                                                       |   | 0.134  |   |   |                                                      |   |   |   |        |   |
| 1288 |                                                                                                                                          |   |        |   |   |                                                      |   |   |   |        |   |
| 1289 | <b>DL/2 Statistics</b>                                                                                                                   |   |        |   |   |                                                      |   |   |   |        |   |
| 1290 | <b>DL/2 Normal</b>                                                                                                                       |   |        |   |   | <b>DL/2 Log-Transformed</b>                          |   |   |   |        |   |
| 1291 | Mean in Original Scale                                                                                                                   |   | 2.149  |   |   | Mean in Log Scale                                    |   |   |   | -0.279 |   |
| 1292 | SD in Original Scale                                                                                                                     |   | 7.643  |   |   | SD in Log Scale                                      |   |   |   | 1.105  |   |
| 1293 | 95% t UCL (Assumes normality)                                                                                                            |   | 3.175  |   |   | 95% H-Stat UCL                                       |   |   |   | 1.714  |   |
| 1294 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |        |   |   |                                                      |   |   |   |        |   |
| 1295 |                                                                                                                                          |   |        |   |   |                                                      |   |   |   |        |   |
| 1296 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |        |   |   |                                                      |   |   |   |        |   |
| 1297 | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                            |   |        |   |   |                                                      |   |   |   |        |   |
| 1298 |                                                                                                                                          |   |        |   |   |                                                      |   |   |   |        |   |
| 1299 | <b>Suggested UCL to Use</b>                                                                                                              |   |        |   |   |                                                      |   |   |   |        |   |
| 1300 | 95% KM (Chebyshev) UCL                                                                                                                   |   | 4.83   |   |   |                                                      |   |   |   |        |   |
| 1301 |                                                                                                                                          |   |        |   |   |                                                      |   |   |   |        |   |
| 1302 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |   |   |                                                      |   |   |   |        |   |
| 1303 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |   |   |                                                      |   |   |   |        |   |
| 1304 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |   |   |                                                      |   |   |   |        |   |
| 1305 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |   |   |                                                      |   |   |   |        |   |
| 1306 |                                                                                                                                          |   |        |   |   |                                                      |   |   |   |        |   |
| 1307 | <b>Result (eu7_chromium)</b>                                                                                                             |   |        |   |   |                                                      |   |   |   |        |   |
| 1308 |                                                                                                                                          |   |        |   |   |                                                      |   |   |   |        |   |
| 1309 | <b>General Statistics</b>                                                                                                                |   |        |   |   |                                                      |   |   |   |        |   |
| 1310 | Total Number of Observations                                                                                                             |   | 152    |   |   | Number of Distinct Observations                      |   |   |   | 5      |   |
| 1311 | Number of Detects                                                                                                                        |   | 3      |   |   | Number of Non-Detects                                |   |   |   | 149    |   |
| 1312 | Number of Distinct Detects                                                                                                               |   | 3      |   |   | Number of Distinct Non-Detects                       |   |   |   | 2      |   |
| 1313 | Minimum Detect                                                                                                                           |   | 0.13   |   |   | Minimum Non-Detect                                   |   |   |   | 0.035  |   |
| 1314 | Maximum Detect                                                                                                                           |   | 8.76   |   |   | Maximum Non-Detect                                   |   |   |   | 5      |   |
| 1315 | Variance Detects                                                                                                                         |   | 24.71  |   |   | Percent Non-Detects                                  |   |   |   | 98.03% |   |
| 1316 | Mean Detects                                                                                                                             |   | 3.02   |   |   | SD Detects                                           |   |   |   | 4.971  |   |
| 1317 | Median Detects                                                                                                                           |   | 0.17   |   |   | CV Detects                                           |   |   |   | 1.646  |   |
| 1318 | Skewness Detects                                                                                                                         |   | 1.732  |   |   | Kurtosis Detects                                     |   |   |   | N/A    |   |
| 1319 | Mean of Logged Detects                                                                                                                   |   | -0.547 |   |   | SD of Logged Detects                                 |   |   |   | 2.357  |   |
| 1320 |                                                                                                                                          |   |        |   |   |                                                      |   |   |   |        |   |
| 1321 | <b>Warning: Data set has only 3 Detected Values.</b>                                                                                     |   |        |   |   |                                                      |   |   |   |        |   |
| 1322 | <b>This is not enough to compute meaningful or reliable statistics and estimates.</b>                                                    |   |        |   |   |                                                      |   |   |   |        |   |
| 1323 |                                                                                                                                          |   |        |   |   |                                                      |   |   |   |        |   |
| 1324 |                                                                                                                                          |   |        |   |   |                                                      |   |   |   |        |   |
| 1325 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |        |   |   |                                                      |   |   |   |        |   |
| 1326 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.753  |   |   | <b>Shapiro Wilk GOF Test</b>                         |   |   |   |        |   |
| 1327 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.767  |   |   | Detected Data Not Normal at 5% Significance Level    |   |   |   |        |   |
| 1328 | Lilliefors Test Statistic                                                                                                                |   | 0.383  |   |   | <b>Lilliefors GOF Test</b>                           |   |   |   |        |   |
| 1329 | 5% Lilliefors Critical Value                                                                                                             |   | 0.425  |   |   | Detected Data appear Normal at 5% Significance Level |   |   |   |        |   |
| 1330 | <b>Detected Data appear Approximate Normal at 5% Significance Level</b>                                                                  |   |        |   |   |                                                      |   |   |   |        |   |
| 1331 |                                                                                                                                          |   |        |   |   |                                                      |   |   |   |        |   |
| 1332 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |        |   |   |                                                      |   |   |   |        |   |
| 1333 | KM Mean                                                                                                                                  |   | 0.118  |   |   | KM Standard Error of Mean                            |   |   |   | 0.0726 |   |
| 1334 | KM SD                                                                                                                                    |   | 0.705  |   |   | 95% KM (BCA) UCL                                     |   |   |   | N/A    |   |
| 1335 | 95% KM (t) UCL                                                                                                                           |   | 0.238  |   |   | 95% KM (Percentile Bootstrap) UCL                    |   |   |   | N/A    |   |
| 1336 | 95% KM (z) UCL                                                                                                                           |   | 0.237  |   |   | 95% KM Bootstrap t UCL                               |   |   |   | N/A    |   |
| 1337 | 90% KM Chebyshev UCL                                                                                                                     |   | 0.336  |   |   | 95% KM Chebyshev UCL                                 |   |   |   | 0.434  |   |
| 1338 | 97.5% KM Chebyshev UCL                                                                                                                   |   | 0.571  |   |   | 99% KM Chebyshev UCL                                 |   |   |   | 0.84   |   |
| 1339 |                                                                                                                                          |   |        |   |   |                                                      |   |   |   |        |   |
| 1340 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |   |        |   |   |                                                      |   |   |   |        |   |

|      | A                                                                                                                         | B | C      | D | E                                                       | F | G                           | H | I | J | K | L |
|------|---------------------------------------------------------------------------------------------------------------------------|---|--------|---|---------------------------------------------------------|---|-----------------------------|---|---|---|---|---|
| 1341 | <b>Not Enough Data to Perform GOF Test</b>                                                                                |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1342 |                                                                                                                           |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1343 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1344 | k hat (MLE)                                                                                                               |   | 0.398  |   | k star (bias corrected MLE)                             |   | N/A                         |   |   |   |   |   |
| 1345 | Theta hat (MLE)                                                                                                           |   | 7.58   |   | Theta star (bias corrected MLE)                         |   | N/A                         |   |   |   |   |   |
| 1346 | nu hat (MLE)                                                                                                              |   | 2.391  |   | nu star (bias corrected)                                |   | N/A                         |   |   |   |   |   |
| 1347 | Mean (detects)                                                                                                            |   | 3.02   |   |                                                         |   |                             |   |   |   |   |   |
| 1348 |                                                                                                                           |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1349 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1350 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1351 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1352 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1353 | This is especially true when the sample size is small.                                                                    |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1354 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1355 | Minimum                                                                                                                   |   | 0.01   |   | Mean                                                    |   | 0.25                        |   |   |   |   |   |
| 1356 | Maximum                                                                                                                   |   | 8.76   |   | Median                                                  |   | 0.01                        |   |   |   |   |   |
| 1357 | SD                                                                                                                        |   | 0.989  |   | CV                                                      |   | 3.95                        |   |   |   |   |   |
| 1358 | k hat (MLE)                                                                                                               |   | 0.266  |   | k star (bias corrected MLE)                             |   | 0.265                       |   |   |   |   |   |
| 1359 | Theta hat (MLE)                                                                                                           |   | 0.943  |   | Theta star (bias corrected MLE)                         |   | 0.946                       |   |   |   |   |   |
| 1360 | nu hat (MLE)                                                                                                              |   | 80.73  |   | nu star (bias corrected)                                |   | 80.47                       |   |   |   |   |   |
| 1361 | Adjusted Level of Significance ( $\beta$ )                                                                                |   | 0.0484 |   |                                                         |   |                             |   |   |   |   |   |
| 1362 | Approximate Chi Square Value (80.47, $\alpha$ )                                                                           |   | 60.8   |   | Adjusted Chi Square Value (80.47, $\beta$ )             |   | 60.64                       |   |   |   |   |   |
| 1363 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   | 0.331  |   | 95% Gamma Adjusted UCL (use when $n < 50$ )             |   | N/A                         |   |   |   |   |   |
| 1364 |                                                                                                                           |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1365 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1366 | Mean (KM)                                                                                                                 |   | 0.118  |   | SD (KM)                                                 |   | 0.705                       |   |   |   |   |   |
| 1367 | Variance (KM)                                                                                                             |   | 0.497  |   | SE of Mean (KM)                                         |   | 0.0726                      |   |   |   |   |   |
| 1368 | k hat (KM)                                                                                                                |   | 0.0279 |   | k star (KM)                                             |   | 0.0318                      |   |   |   |   |   |
| 1369 | nu hat (KM)                                                                                                               |   | 8.487  |   | nu star (KM)                                            |   | 9.653                       |   |   |   |   |   |
| 1370 | theta hat (KM)                                                                                                            |   | 4.219  |   | theta star (KM)                                         |   | 3.71                        |   |   |   |   |   |
| 1371 | 80% gamma percentile (KM)                                                                                                 |   | 0.0019 |   | 90% gamma percentile (KM)                               |   | 0.079                       |   |   |   |   |   |
| 1372 | 95% gamma percentile (KM)                                                                                                 |   | 0.48   |   | 99% gamma percentile (KM)                               |   | 2.994                       |   |   |   |   |   |
| 1373 |                                                                                                                           |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1374 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1375 | Approximate Chi Square Value (9.65, $\alpha$ )                                                                            |   | 3.726  |   | Adjusted Chi Square Value (9.65, $\beta$ )              |   | 3.691                       |   |   |   |   |   |
| 1376 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   | 0.305  |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )          |   | 0.308                       |   |   |   |   |   |
| 1377 |                                                                                                                           |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1378 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1379 | Shapiro Wilk Test Statistic                                                                                               |   | 0.798  |   | <b>Shapiro Wilk GOF Test</b>                            |   |                             |   |   |   |   |   |
| 1380 | 5% Shapiro Wilk Critical Value                                                                                            |   | 0.767  |   | Detected Data appear Lognormal at 5% Significance Level |   |                             |   |   |   |   |   |
| 1381 | Lilliefors Test Statistic                                                                                                 |   | 0.365  |   | <b>Lilliefors GOF Test</b>                              |   |                             |   |   |   |   |   |
| 1382 | 5% Lilliefors Critical Value                                                                                              |   | 0.425  |   | Detected Data appear Lognormal at 5% Significance Level |   |                             |   |   |   |   |   |
| 1383 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                            |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1384 |                                                                                                                           |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1385 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1386 | Mean in Original Scale                                                                                                    |   | 0.132  |   | Mean in Log Scale                                       |   | -5.022                      |   |   |   |   |   |
| 1387 | SD in Original Scale                                                                                                      |   | 0.744  |   | SD in Log Scale                                         |   | 2.539                       |   |   |   |   |   |
| 1388 | 95% t UCL (assumes normality of ROS data)                                                                                 |   | 0.232  |   | 95% Percentile Bootstrap UCL                            |   | 0.247                       |   |   |   |   |   |
| 1389 | 95% BCA Bootstrap UCL                                                                                                     |   | 0.325  |   | 95% Bootstrap t UCL                                     |   | 0.5                         |   |   |   |   |   |
| 1390 | 95% H-UCL (Log ROS)                                                                                                       |   | 0.376  |   |                                                         |   |                             |   |   |   |   |   |
| 1391 |                                                                                                                           |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1392 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1393 | KM Mean (logged)                                                                                                          |   | -2.997 |   | KM Geo Mean                                             |   | 0.0499                      |   |   |   |   |   |
| 1394 | KM SD (logged)                                                                                                            |   | 0.735  |   | 95% Critical H Value (KM-Log)                           |   | 1.985                       |   |   |   |   |   |
| 1395 | KM Standard Error of Mean (logged)                                                                                        |   | 0.249  |   | 95% H-UCL (KM -Log)                                     |   | 0.0737                      |   |   |   |   |   |
| 1396 | KM SD (logged)                                                                                                            |   | 0.735  |   | 95% Critical H Value (KM-Log)                           |   | 1.985                       |   |   |   |   |   |
| 1397 | KM Standard Error of Mean (logged)                                                                                        |   | 0.249  |   |                                                         |   |                             |   |   |   |   |   |
| 1398 |                                                                                                                           |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1399 | <b>DL/2 Statistics</b>                                                                                                    |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1400 | <b>DL/2 Normal</b>                                                                                                        |   |        |   |                                                         |   | <b>DL/2 Log-Transformed</b> |   |   |   |   |   |
| 1401 | Mean in Original Scale                                                                                                    |   | 2.396  |   | Mean in Log Scale                                       |   | 0.659                       |   |   |   |   |   |
| 1402 | SD in Original Scale                                                                                                      |   | 0.779  |   | SD in Log Scale                                         |   | 1.091                       |   |   |   |   |   |
| 1403 | 95% t UCL (Assumes normality)                                                                                             |   | 2.501  |   | 95% H-Stat UCL                                          |   | 4.296                       |   |   |   |   |   |
| 1404 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                  |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1405 |                                                                                                                           |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1406 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                     |   |        |   |                                                         |   |                             |   |   |   |   |   |
| 1407 | Detected Data appear Approximate Normal Distributed at 5% Significance Level                                              |   |        |   |                                                         |   |                             |   |   |   |   |   |

|      | A                                                                                                                                        | B | C | D      | E | F                                                               | G | H | I      | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|---|-----------------------------------------------------------------|---|---|--------|---|---|---|
| 1408 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1409 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1410 | 95% KM (t) UCL                                                                                                                           |   |   | 0.238  |   |                                                                 |   |   |        |   |   |   |
| 1411 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1412 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                           |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1413 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                   |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1414 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1415 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1416 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1417 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1418 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1419 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1420 | <b>Result (eu7_cobalt)</b>                                                                                                               |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1421 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1422 | <b>General Statistics</b>                                                                                                                |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1423 | Total Number of Observations                                                                                                             |   |   | 83     |   | Number of Distinct Observations                                 |   |   | 18     |   |   |   |
| 1424 | Number of Detects                                                                                                                        |   |   | 17     |   | Number of Non-Detects                                           |   |   | 66     |   |   |   |
| 1425 | Number of Distinct Detects                                                                                                               |   |   | 17     |   | Number of Distinct Non-Detects                                  |   |   | 1      |   |   |   |
| 1426 | Minimum Detect                                                                                                                           |   |   | 0.16   |   | Minimum Non-Detect                                              |   |   | 0.5    |   |   |   |
| 1427 | Maximum Detect                                                                                                                           |   |   | 29.1   |   | Maximum Non-Detect                                              |   |   | 0.5    |   |   |   |
| 1428 | Variance Detects                                                                                                                         |   |   | 75.93  |   | Percent Non-Detects                                             |   |   | 79.52% |   |   |   |
| 1429 | Mean Detects                                                                                                                             |   |   | 7.481  |   | SD Detects                                                      |   |   | 8.714  |   |   |   |
| 1430 | Median Detects                                                                                                                           |   |   | 3.38   |   | CV Detects                                                      |   |   | 1.165  |   |   |   |
| 1431 | Skewness Detects                                                                                                                         |   |   | 1.419  |   | Kurtosis Detects                                                |   |   | 1.37   |   |   |   |
| 1432 | Mean of Logged Detects                                                                                                                   |   |   | 1.048  |   | SD of Logged Detects                                            |   |   | 1.713  |   |   |   |
| 1433 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1434 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1435 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.814  |   | <b>Shapiro Wilk GOF Test</b>                                    |   |   |        |   |   |   |
| 1436 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.892  |   | Detected Data Not Normal at 5% Significance Level               |   |   |        |   |   |   |
| 1437 | Lilliefors Test Statistic                                                                                                                |   |   | 0.21   |   | <b>Lilliefors GOF Test</b>                                      |   |   |        |   |   |   |
| 1438 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.207  |   | Detected Data Not Normal at 5% Significance Level               |   |   |        |   |   |   |
| 1439 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1440 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1441 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1442 | KM Mean                                                                                                                                  |   |   | 1.689  |   | KM Standard Error of Mean                                       |   |   | 0.546  |   |   |   |
| 1443 | KM SD                                                                                                                                    |   |   | 4.825  |   | 95% KM (BCA) UCL                                                |   |   | 2.63   |   |   |   |
| 1444 | 95% KM (t) UCL                                                                                                                           |   |   | 2.597  |   | 95% KM (Percentile Bootstrap) UCL                               |   |   | 2.628  |   |   |   |
| 1445 | 95% KM (z) UCL                                                                                                                           |   |   | 2.587  |   | 95% KM Bootstrap t UCL                                          |   |   | 3.166  |   |   |   |
| 1446 | 90% KM Chebyshev UCL                                                                                                                     |   |   | 3.327  |   | 95% KM Chebyshev UCL                                            |   |   | 4.069  |   |   |   |
| 1447 | 97.5% KM Chebyshev UCL                                                                                                                   |   |   | 5.099  |   | 99% KM Chebyshev UCL                                            |   |   | 7.122  |   |   |   |
| 1448 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1449 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1450 | A-D Test Statistic                                                                                                                       |   |   | 0.28   |   | <b>Anderson-Darling GOF Test</b>                                |   |   |        |   |   |   |
| 1451 | 5% A-D Critical Value                                                                                                                    |   |   | 0.786  |   | detected data appear Gamma Distributed at 5% Significance Level |   |   |        |   |   |   |
| 1452 | K-S Test Statistic                                                                                                                       |   |   | 0.12   |   | <b>Kolmogorov-Smirnov GOF</b>                                   |   |   |        |   |   |   |
| 1453 | 5% K-S Critical Value                                                                                                                    |   |   | 0.219  |   | detected data appear Gamma Distributed at 5% Significance Level |   |   |        |   |   |   |
| 1454 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1455 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1456 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1457 | k hat (MLE)                                                                                                                              |   |   | 0.636  |   | k star (bias corrected MLE)                                     |   |   | 0.563  |   |   |   |
| 1458 | Theta hat (MLE)                                                                                                                          |   |   | 11.77  |   | Theta star (bias corrected MLE)                                 |   |   | 13.3   |   |   |   |
| 1459 | nu hat (MLE)                                                                                                                             |   |   | 21.61  |   | nu star (bias corrected)                                        |   |   | 19.13  |   |   |   |
| 1460 | Mean (detects)                                                                                                                           |   |   | 7.481  |   |                                                                 |   |   |        |   |   |   |
| 1461 |                                                                                                                                          |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1462 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1463 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1464 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1465 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1466 | This is especially true when the sample size is small.                                                                                   |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1467 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |   |   |        |   |                                                                 |   |   |        |   |   |   |
| 1468 | Minimum                                                                                                                                  |   |   | 0.01   |   | Mean                                                            |   |   | 1.659  |   |   |   |
| 1469 | Maximum                                                                                                                                  |   |   | 29.1   |   | Median                                                          |   |   | 0.01   |   |   |   |
| 1470 | SD                                                                                                                                       |   |   | 4.885  |   | CV                                                              |   |   | 2.944  |   |   |   |
| 1471 | k hat (MLE)                                                                                                                              |   |   | 0.206  |   | k star (bias corrected MLE)                                     |   |   | 0.207  |   |   |   |
| 1472 | Theta hat (MLE)                                                                                                                          |   |   | 8.051  |   | Theta star (bias corrected MLE)                                 |   |   | 8.029  |   |   |   |
| 1473 | nu hat (MLE)                                                                                                                             |   |   | 34.21  |   | nu star (bias corrected)                                        |   |   | 34.3   |   |   |   |
| 1474 | Adjusted Level of Significance ( $\beta$ )                                                                                               |   |   | 0.0471 |   |                                                                 |   |   |        |   |   |   |

| A    | B                                                                                                                                        | C | D | E      | F                                                       | G                                              | H | I      | J | K     | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|---------------------------------------------------------|------------------------------------------------|---|--------|---|-------|---|--|
| 1475 | Approximate Chi Square Value (34.30, $\alpha$ )                                                                                          |   |   |        | 21.91                                                   | Adjusted Chi Square Value (34.30, $\beta$ )    |   |        |   | 21.73 |   |  |
| 1476 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                                        |   |   |        | 2.598                                                   | 95% Gamma Adjusted UCL (use when $n < 50$ )    |   |        |   | 2.619 |   |  |
| 1477 |                                                                                                                                          |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1478 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1479 | Mean (KM)                                                                                                                                |   |   | 1.689  | SD (KM)                                                 |                                                |   | 4.825  |   |       |   |  |
| 1480 | Variance (KM)                                                                                                                            |   |   | 23.28  | SE of Mean (KM)                                         |                                                |   | 0.546  |   |       |   |  |
| 1481 | k hat (KM)                                                                                                                               |   |   | 0.122  | k star (KM)                                             |                                                |   | 0.126  |   |       |   |  |
| 1482 | nu hat (KM)                                                                                                                              |   |   | 20.33  | nu star (KM)                                            |                                                |   | 20.93  |   |       |   |  |
| 1483 | theta hat (KM)                                                                                                                           |   |   | 13.79  | theta star (KM)                                         |                                                |   | 13.39  |   |       |   |  |
| 1484 | 80% gamma percentile (KM)                                                                                                                |   |   | 1.563  | 90% gamma percentile (KM)                               |                                                |   | 4.846  |   |       |   |  |
| 1485 | 95% gamma percentile (KM)                                                                                                                |   |   | 9.572  | 99% gamma percentile (KM)                               |                                                |   | 23.82  |   |       |   |  |
| 1486 |                                                                                                                                          |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1487 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1488 | Approximate Chi Square Value (20.93, $\alpha$ )                                                                                          |   |   |        | 11.54                                                   | Adjusted Chi Square Value (20.93, $\beta$ )    |   |        |   | 11.42 |   |  |
| 1489 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                      |   |   |        | 3.063                                                   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ ) |   |        |   | 3.096 |   |  |
| 1490 |                                                                                                                                          |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1491 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1492 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.926  | <b>Shapiro Wilk GOF Test</b>                            |                                                |   |        |   |       |   |  |
| 1493 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.892  | Detected Data appear Lognormal at 5% Significance Level |                                                |   |        |   |       |   |  |
| 1494 | Lilliefors Test Statistic                                                                                                                |   |   | 0.155  | <b>Lilliefors GOF Test</b>                              |                                                |   |        |   |       |   |  |
| 1495 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.207  | Detected Data appear Lognormal at 5% Significance Level |                                                |   |        |   |       |   |  |
| 1496 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                           |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1497 |                                                                                                                                          |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1498 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1499 | Mean in Original Scale                                                                                                                   |   |   | 1.813  | Mean in Log Scale                                       |                                                |   | -1.303 |   |       |   |  |
| 1500 | SD in Original Scale                                                                                                                     |   |   | 4.83   | SD in Log Scale                                         |                                                |   | 1.973  |   |       |   |  |
| 1501 | 95% t UCL (assumes normality of ROS data)                                                                                                |   |   | 2.695  | 95% Percentile Bootstrap UCL                            |                                                |   | 2.691  |   |       |   |  |
| 1502 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 3.033  | 95% Bootstrap t UCL                                     |                                                |   | 3.309  |   |       |   |  |
| 1503 | 95% H-UCL (Log ROS)                                                                                                                      |   |   | 3.935  |                                                         |                                                |   |        |   |       |   |  |
| 1504 |                                                                                                                                          |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1505 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1506 | KM Mean (logged)                                                                                                                         |   |   | -1.087 | KM Geo Mean                                             |                                                |   | 0.337  |   |       |   |  |
| 1507 | KM SD (logged)                                                                                                                           |   |   | 1.326  | 95% Critical H Value (KM-Log)                           |                                                |   | 2.568  |   |       |   |  |
| 1508 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.167  | 95% H-UCL (KM -Log)                                     |                                                |   | 1.183  |   |       |   |  |
| 1509 | KM SD (logged)                                                                                                                           |   |   | 1.326  | 95% Critical H Value (KM-Log)                           |                                                |   | 2.568  |   |       |   |  |
| 1510 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.167  |                                                         |                                                |   |        |   |       |   |  |
| 1511 |                                                                                                                                          |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1512 | <b>DL/2 Statistics</b>                                                                                                                   |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1513 | <b>DL/2 Normal</b>                                                                                                                       |   |   |        | <b>DL/2 Log-Transformed</b>                             |                                                |   |        |   |       |   |  |
| 1514 | Mean in Original Scale                                                                                                                   |   |   | 1.731  | Mean in Log Scale                                       |                                                |   | -0.888 |   |       |   |  |
| 1515 | SD in Original Scale                                                                                                                     |   |   | 4.841  | SD in Log Scale                                         |                                                |   | 1.245  |   |       |   |  |
| 1516 | 95% t UCL (Assumes normality)                                                                                                            |   |   | 2.615  | 95% H-Stat UCL                                          |                                                |   | 1.257  |   |       |   |  |
| 1517 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1518 |                                                                                                                                          |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1519 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1520 | <b>Detected Data appear Gamma Distributed at 5% Significance Level</b>                                                                   |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1521 |                                                                                                                                          |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1522 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1523 | 95% KM Approximate Gamma UCL                                                                                                             |   |   | 3.063  |                                                         |                                                |   |        |   |       |   |  |
| 1524 |                                                                                                                                          |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1525 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1526 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1527 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1528 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1529 |                                                                                                                                          |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1530 | <b>Result (eu7_copper)</b>                                                                                                               |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1531 |                                                                                                                                          |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1532 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                         |                                                |   |        |   |       |   |  |
| 1533 | Total Number of Observations                                                                                                             |   |   | 152    | Number of Distinct Observations                         |                                                |   | 105    |   |       |   |  |
| 1534 | Number of Detects                                                                                                                        |   |   | 114    | Number of Non-Detects                                   |                                                |   | 38     |   |       |   |  |
| 1535 | Number of Distinct Detects                                                                                                               |   |   | 104    | Number of Distinct Non-Detects                          |                                                |   | 2      |   |       |   |  |
| 1536 | Minimum Detect                                                                                                                           |   |   | 2.4    | Minimum Non-Detect                                      |                                                |   | 0.073  |   |       |   |  |
| 1537 | Maximum Detect                                                                                                                           |   |   | 327    | Maximum Non-Detect                                      |                                                |   | 2.5    |   |       |   |  |
| 1538 | Variance Detects                                                                                                                         |   |   | 2204   | Percent Non-Detects                                     |                                                |   | 25%    |   |       |   |  |
| 1539 | Mean Detects                                                                                                                             |   |   | 20.31  | SD Detects                                              |                                                |   | 46.95  |   |       |   |  |
| 1540 | Median Detects                                                                                                                           |   |   | 8.795  | CV Detects                                              |                                                |   | 2.312  |   |       |   |  |
| 1541 | Skewness Detects                                                                                                                         |   |   | 4.843  | Kurtosis Detects                                        |                                                |   | 24.69  |   |       |   |  |

|      | A                                                                                                                         | B | C | D         | E                                                            | F                    | G | H     | I | J     | K | L |  |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|-----------|--------------------------------------------------------------|----------------------|---|-------|---|-------|---|---|--|
| 1542 | Mean of Logged Detects                                                                                                    |   |   |           | 2.29                                                         | SD of Logged Detects |   |       |   | 0.932 |   |   |  |
| 1543 |                                                                                                                           |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1544 | <b>Normal GOF Test on Detects Only</b>                                                                                    |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1545 | Shapiro Wilk Test Statistic                                                                                               |   |   | 0.358     | <b>Normal GOF Test on Detected Observations Only</b>         |                      |   |       |   |       |   |   |  |
| 1546 | 5% Shapiro Wilk P Value                                                                                                   |   |   | 0         | Detected Data Not Normal at 5% Significance Level            |                      |   |       |   |       |   |   |  |
| 1547 | Lilliefors Test Statistic                                                                                                 |   |   | 0.401     | <b>Lilliefors GOF Test</b>                                   |                      |   |       |   |       |   |   |  |
| 1548 | 5% Lilliefors Critical Value                                                                                              |   |   | 0.0833    | Detected Data Not Normal at 5% Significance Level            |                      |   |       |   |       |   |   |  |
| 1549 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                  |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1550 |                                                                                                                           |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1551 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1552 | KM Mean                                                                                                                   |   |   | 15.38     | KM Standard Error of Mean                                    |                      |   | 3.373 |   |       |   |   |  |
| 1553 | KM SD                                                                                                                     |   |   | 41.37     | 95% KM (BCA) UCL                                             |                      |   | 21.87 |   |       |   |   |  |
| 1554 | 95% KM (t) UCL                                                                                                            |   |   | 20.96     | 95% KM (Percentile Bootstrap) UCL                            |                      |   | 21.49 |   |       |   |   |  |
| 1555 | 95% KM (z) UCL                                                                                                            |   |   | 20.93     | 95% KM Bootstrap t UCL                                       |                      |   | 24.42 |   |       |   |   |  |
| 1556 | 90% KM Chebyshev UCL                                                                                                      |   |   | 25.5      | 95% KM Chebyshev UCL                                         |                      |   | 30.08 |   |       |   |   |  |
| 1557 | 97.5% KM Chebyshev UCL                                                                                                    |   |   | 36.44     | 99% KM Chebyshev UCL                                         |                      |   | 48.94 |   |       |   |   |  |
| 1558 |                                                                                                                           |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1559 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1560 | A-D Test Statistic                                                                                                        |   |   | 12.29     | <b>Anderson-Darling GOF Test</b>                             |                      |   |       |   |       |   |   |  |
| 1561 | 5% A-D Critical Value                                                                                                     |   |   | 0.792     | Detected Data Not Gamma Distributed at 5% Significance Level |                      |   |       |   |       |   |   |  |
| 1562 | K-S Test Statistic                                                                                                        |   |   | 0.271     | <b>Kolmogorov-Smirnov GOF</b>                                |                      |   |       |   |       |   |   |  |
| 1563 | 5% K-S Critical Value                                                                                                     |   |   | 0.089     | Detected Data Not Gamma Distributed at 5% Significance Level |                      |   |       |   |       |   |   |  |
| 1564 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                       |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1565 |                                                                                                                           |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1566 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1567 | k hat (MLE)                                                                                                               |   |   | 0.821     | k star (bias corrected MLE)                                  |                      |   | 0.805 |   |       |   |   |  |
| 1568 | Theta hat (MLE)                                                                                                           |   |   | 24.74     | Theta star (bias corrected MLE)                              |                      |   | 25.23 |   |       |   |   |  |
| 1569 | nu hat (MLE)                                                                                                              |   |   | 187.1     | nu star (bias corrected)                                     |                      |   | 183.5 |   |       |   |   |  |
| 1570 | Mean (detects)                                                                                                            |   |   | 20.31     |                                                              |                      |   |       |   |       |   |   |  |
| 1571 |                                                                                                                           |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1572 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1573 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1574 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1575 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1576 | This is especially true when the sample size is small.                                                                    |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1577 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1578 | Minimum                                                                                                                   |   |   | 0.01      | Mean                                                         |                      |   | 15.23 |   |       |   |   |  |
| 1579 | Maximum                                                                                                                   |   |   | 327       | Median                                                       |                      |   | 6.69  |   |       |   |   |  |
| 1580 | SD                                                                                                                        |   |   | 41.56     | CV                                                           |                      |   | 2.728 |   |       |   |   |  |
| 1581 | k hat (MLE)                                                                                                               |   |   | 0.317     | k star (bias corrected MLE)                                  |                      |   | 0.315 |   |       |   |   |  |
| 1582 | Theta hat (MLE)                                                                                                           |   |   | 48.08     | Theta star (bias corrected MLE)                              |                      |   | 48.36 |   |       |   |   |  |
| 1583 | nu hat (MLE)                                                                                                              |   |   | 96.32     | nu star (bias corrected)                                     |                      |   | 95.75 |   |       |   |   |  |
| 1584 | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   | 0.0484    |                                                              |                      |   |       |   |       |   |   |  |
| 1585 | Approximate Chi Square Value (95.75, $\alpha$ )                                                                           |   |   | 74.18     | Adjusted Chi Square Value (95.75, $\beta$ )                  |                      |   | 74    |   |       |   |   |  |
| 1586 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   | 19.66     | 95% Gamma Adjusted UCL (use when $n < 50$ )                  |                      |   | 19.71 |   |       |   |   |  |
| 1587 |                                                                                                                           |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1588 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1589 | Mean (KM)                                                                                                                 |   |   | 15.38     | SD (KM)                                                      |                      |   | 41.37 |   |       |   |   |  |
| 1590 | Variance (KM)                                                                                                             |   |   | 1711      | SE of Mean (KM)                                              |                      |   | 3.373 |   |       |   |   |  |
| 1591 | k hat (KM)                                                                                                                |   |   | 0.138     | k star (KM)                                                  |                      |   | 0.14  |   |       |   |   |  |
| 1592 | nu hat (KM)                                                                                                               |   |   | 42.03     | nu star (KM)                                                 |                      |   | 42.53 |   |       |   |   |  |
| 1593 | theta hat (KM)                                                                                                            |   |   | 111.3     | theta star (KM)                                              |                      |   | 109.9 |   |       |   |   |  |
| 1594 | 80% gamma percentile (KM)                                                                                                 |   |   | 15.77     | 90% gamma percentile (KM)                                    |                      |   | 45.12 |   |       |   |   |  |
| 1595 | 95% gamma percentile (KM)                                                                                                 |   |   | 85.76     | 99% gamma percentile (KM)                                    |                      |   | 205.5 |   |       |   |   |  |
| 1596 |                                                                                                                           |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1597 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1598 | Approximate Chi Square Value (42.53, $\alpha$ )                                                                           |   |   | 28.58     | Adjusted Chi Square Value (42.53, $\beta$ )                  |                      |   | 28.47 |   |       |   |   |  |
| 1599 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   |   | 22.89     | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )               |                      |   | 22.98 |   |       |   |   |  |
| 1600 |                                                                                                                           |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1601 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1602 | Shapiro Wilk Approximate Test Statistic                                                                                   |   |   | 0.869     | <b>Shapiro Wilk GOF Test</b>                                 |                      |   |       |   |       |   |   |  |
| 1603 | 5% Shapiro Wilk P Value                                                                                                   |   |   | 3.886E-15 | Detected Data Not Lognormal at 5% Significance Level         |                      |   |       |   |       |   |   |  |
| 1604 | Lilliefors Test Statistic                                                                                                 |   |   | 0.136     | <b>Lilliefors GOF Test</b>                                   |                      |   |       |   |       |   |   |  |
| 1605 | 5% Lilliefors Critical Value                                                                                              |   |   | 0.0833    | Detected Data Not Lognormal at 5% Significance Level         |                      |   |       |   |       |   |   |  |
| 1606 | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                               |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1607 |                                                                                                                           |   |   |           |                                                              |                      |   |       |   |       |   |   |  |
| 1608 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |   |   |           |                                                              |                      |   |       |   |       |   |   |  |

| A    | B                                                                                                                                        | C | D | E | F        | G                                                            | H | I | J | K     | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|----------|--------------------------------------------------------------|---|---|---|-------|---|
| 1609 | Mean in Original Scale                                                                                                                   |   |   |   | 15.58    | Mean in Log Scale                                            |   |   |   | 1.771 |   |
| 1610 | SD in Original Scale                                                                                                                     |   |   |   | 41.43    | SD in Log Scale                                              |   |   |   | 1.24  |   |
| 1611 | 95% t UCL (assumes normality of ROS data)                                                                                                |   |   |   | 21.14    | 95% Percentile Bootstrap UCL                                 |   |   |   | 21.59 |   |
| 1612 | 95% BCA Bootstrap UCL                                                                                                                    |   |   |   | 22.51    | 95% Bootstrap t UCL                                          |   |   |   | 24.14 |   |
| 1613 | 95% H-UCL (Log ROS)                                                                                                                      |   |   |   | 16.22    |                                                              |   |   |   |       |   |
| 1614 |                                                                                                                                          |   |   |   |          |                                                              |   |   |   |       |   |
| 1615 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |   |   |          |                                                              |   |   |   |       |   |
| 1616 | KM Mean (logged)                                                                                                                         |   |   |   | 1.264    | KM Geo Mean                                                  |   |   |   | 3.541 |   |
| 1617 | KM SD (logged)                                                                                                                           |   |   |   | 2.084    | 95% Critical H Value (KM-Log)                                |   |   |   | 3.401 |   |
| 1618 | KM Standard Error of Mean (logged)                                                                                                       |   |   |   | 0.251    | 95% H-UCL (KM -Log)                                          |   |   |   | 55.29 |   |
| 1619 | KM SD (logged)                                                                                                                           |   |   |   | 2.084    | 95% Critical H Value (KM-Log)                                |   |   |   | 3.401 |   |
| 1620 | KM Standard Error of Mean (logged)                                                                                                       |   |   |   | 0.251    |                                                              |   |   |   |       |   |
| 1621 |                                                                                                                                          |   |   |   |          |                                                              |   |   |   |       |   |
| 1622 | <b>DL/2 Statistics</b>                                                                                                                   |   |   |   |          |                                                              |   |   |   |       |   |
| 1623 | <b>DL/2 Normal</b>                                                                                                                       |   |   |   |          | <b>DL/2 Log-Transformed</b>                                  |   |   |   |       |   |
| 1624 | Mean in Original Scale                                                                                                                   |   |   |   | 15.52    | Mean in Log Scale                                            |   |   |   | 1.704 |   |
| 1625 | SD in Original Scale                                                                                                                     |   |   |   | 41.46    | SD in Log Scale                                              |   |   |   | 1.385 |   |
| 1626 | 95% t UCL (Assumes normality)                                                                                                            |   |   |   | 21.08    | 95% H-Stat UCL                                               |   |   |   | 19.18 |   |
| 1627 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |   |   |          |                                                              |   |   |   |       |   |
| 1628 |                                                                                                                                          |   |   |   |          |                                                              |   |   |   |       |   |
| 1629 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |   |          |                                                              |   |   |   |       |   |
| 1630 | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                            |   |   |   |          |                                                              |   |   |   |       |   |
| 1631 |                                                                                                                                          |   |   |   |          |                                                              |   |   |   |       |   |
| 1632 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |   |          |                                                              |   |   |   |       |   |
| 1633 | 95% KM (Chebyshev) UCL                                                                                                                   |   |   |   | 30.08    |                                                              |   |   |   |       |   |
| 1634 |                                                                                                                                          |   |   |   |          |                                                              |   |   |   |       |   |
| 1635 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |   |          |                                                              |   |   |   |       |   |
| 1636 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |   |          |                                                              |   |   |   |       |   |
| 1637 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |   |          |                                                              |   |   |   |       |   |
| 1638 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |   |          |                                                              |   |   |   |       |   |
| 1639 |                                                                                                                                          |   |   |   |          |                                                              |   |   |   |       |   |
| 1640 | <b>Result (eu7_iron)</b>                                                                                                                 |   |   |   |          |                                                              |   |   |   |       |   |
| 1641 |                                                                                                                                          |   |   |   |          |                                                              |   |   |   |       |   |
| 1642 | <b>General Statistics</b>                                                                                                                |   |   |   |          |                                                              |   |   |   |       |   |
| 1643 | Total Number of Observations                                                                                                             |   |   |   | 150      | Number of Distinct Observations                              |   |   |   | 83    |   |
| 1644 | Number of Detects                                                                                                                        |   |   |   | 96       | Number of Non-Detects                                        |   |   |   | 54    |   |
| 1645 | Number of Distinct Detects                                                                                                               |   |   |   | 81       | Number of Distinct Non-Detects                               |   |   |   | 2     |   |
| 1646 | Minimum Detect                                                                                                                           |   |   |   | 101      | Minimum Non-Detect                                           |   |   |   | 2.1   |   |
| 1647 | Maximum Detect                                                                                                                           |   |   |   | 31100    | Maximum Non-Detect                                           |   |   |   | 100   |   |
| 1648 | Variance Detects                                                                                                                         |   |   |   | 27478792 | Percent Non-Detects                                          |   |   |   | 36%   |   |
| 1649 | Mean Detects                                                                                                                             |   |   |   | 2412     | SD Detects                                                   |   |   |   | 5242  |   |
| 1650 | Median Detects                                                                                                                           |   |   |   | 240.5    | CV Detects                                                   |   |   |   | 2.174 |   |
| 1651 | Skewness Detects                                                                                                                         |   |   |   | 3.264    | Kurtosis Detects                                             |   |   |   | 12.05 |   |
| 1652 | Mean of Logged Detects                                                                                                                   |   |   |   | 6.223    | SD of Logged Detects                                         |   |   |   | 1.606 |   |
| 1653 |                                                                                                                                          |   |   |   |          |                                                              |   |   |   |       |   |
| 1654 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |   |   |          |                                                              |   |   |   |       |   |
| 1655 | Shapiro Wilk Test Statistic                                                                                                              |   |   |   | 0.515    | <b>Normal GOF Test on Detected Observations Only</b>         |   |   |   |       |   |
| 1656 | 5% Shapiro Wilk P Value                                                                                                                  |   |   |   | 0        | Detected Data Not Normal at 5% Significance Level            |   |   |   |       |   |
| 1657 | Lilliefors Test Statistic                                                                                                                |   |   |   | 0.368    | <b>Lilliefors GOF Test</b>                                   |   |   |   |       |   |
| 1658 | 5% Lilliefors Critical Value                                                                                                             |   |   |   | 0.0907   | Detected Data Not Normal at 5% Significance Level            |   |   |   |       |   |
| 1659 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |   |   |   |          |                                                              |   |   |   |       |   |
| 1660 |                                                                                                                                          |   |   |   |          |                                                              |   |   |   |       |   |
| 1661 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |   |   |          |                                                              |   |   |   |       |   |
| 1662 | KM Mean                                                                                                                                  |   |   |   | 1544     | KM Standard Error of Mean                                    |   |   |   | 355.3 |   |
| 1663 | KM SD                                                                                                                                    |   |   |   | 4329     | 95% KM (BCA) UCL                                             |   |   |   | 2093  |   |
| 1664 | 95% KM (t) UCL                                                                                                                           |   |   |   | 2132     | 95% KM (Percentile Bootstrap) UCL                            |   |   |   | 2175  |   |
| 1665 | 95% KM (z) UCL                                                                                                                           |   |   |   | 2129     | 95% KM Bootstrap t UCL                                       |   |   |   | 2339  |   |
| 1666 | 90% KM Chebyshev UCL                                                                                                                     |   |   |   | 2610     | 95% KM Chebyshev UCL                                         |   |   |   | 3093  |   |
| 1667 | 97.5% KM Chebyshev UCL                                                                                                                   |   |   |   | 3763     | 99% KM Chebyshev UCL                                         |   |   |   | 5080  |   |
| 1668 |                                                                                                                                          |   |   |   |          |                                                              |   |   |   |       |   |
| 1669 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |   |   |   |          |                                                              |   |   |   |       |   |
| 1670 | A-D Test Statistic                                                                                                                       |   |   |   | 11.52    | <b>Anderson-Darling GOF Test</b>                             |   |   |   |       |   |
| 1671 | 5% A-D Critical Value                                                                                                                    |   |   |   | 0.839    | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |   |       |   |
| 1672 | K-S Test Statistic                                                                                                                       |   |   |   | 0.296    | <b>Kolmogorov-Smirnov GOF</b>                                |   |   |   |       |   |
| 1673 | 5% K-S Critical Value                                                                                                                    |   |   |   | 0.0977   | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |   |       |   |
| 1674 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                                      |   |   |   |          |                                                              |   |   |   |       |   |
| 1675 |                                                                                                                                          |   |   |   |          |                                                              |   |   |   |       |   |

|      | A                                                                                                                         | B | C | D        | E                                                    | F | G                           | H     | I | J | K | L |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|----------|------------------------------------------------------|---|-----------------------------|-------|---|---|---|---|
| 1676 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1677 | k hat (MLE)                                                                                                               |   |   | 0.417    | k star (bias corrected MLE)                          |   |                             | 0.411 |   |   |   |   |
| 1678 | Theta hat (MLE)                                                                                                           |   |   | 5776     | Theta star (bias corrected MLE)                      |   |                             | 5862  |   |   |   |   |
| 1679 | nu hat (MLE)                                                                                                              |   |   | 80.16    | nu star (bias corrected)                             |   |                             | 78.99 |   |   |   |   |
| 1680 | Mean (detects)                                                                                                            |   |   | 2412     |                                                      |   |                             |       |   |   |   |   |
| 1681 |                                                                                                                           |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1682 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1683 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1684 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1685 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1686 | This is especially true when the sample size is small.                                                                    |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1687 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1688 | Minimum                                                                                                                   |   |   | 0.01     | Mean                                                 |   |                             | 1543  |   |   |   |   |
| 1689 | Maximum                                                                                                                   |   |   | 31100    | Median                                               |   |                             | 157   |   |   |   |   |
| 1690 | SD                                                                                                                        |   |   | 4344     | CV                                                   |   |                             | 2.814 |   |   |   |   |
| 1691 | k hat (MLE)                                                                                                               |   |   | 0.153    | k star (bias corrected MLE)                          |   |                             | 0.154 |   |   |   |   |
| 1692 | Theta hat (MLE)                                                                                                           |   |   | 10102    | Theta star (bias corrected MLE)                      |   |                             | 10011 |   |   |   |   |
| 1693 | nu hat (MLE)                                                                                                              |   |   | 45.83    | nu star (bias corrected)                             |   |                             | 46.25 |   |   |   |   |
| 1694 | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   | 0.0484   |                                                      |   |                             |       |   |   |   |   |
| 1695 | Approximate Chi Square Value (46.25, $\alpha$ )                                                                           |   |   | 31.65    | Adjusted Chi Square Value (46.25, $\beta$ )          |   |                             | 31.53 |   |   |   |   |
| 1696 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   | 2256     | 95% Gamma Adjusted UCL (use when $n < 50$ )          |   |                             | 2264  |   |   |   |   |
| 1697 |                                                                                                                           |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1698 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1699 | Mean (KM)                                                                                                                 |   |   | 1544     | SD (KM)                                              |   |                             | 4329  |   |   |   |   |
| 1700 | Variance (KM)                                                                                                             |   |   | 18740790 | SE of Mean (KM)                                      |   |                             | 355.3 |   |   |   |   |
| 1701 | k hat (KM)                                                                                                                |   |   | 0.127    | k star (KM)                                          |   |                             | 0.129 |   |   |   |   |
| 1702 | nu hat (KM)                                                                                                               |   |   | 38.17    | nu star (KM)                                         |   |                             | 38.74 |   |   |   |   |
| 1703 | theta hat (KM)                                                                                                            |   |   | 12137    | theta star (KM)                                      |   |                             | 11958 |   |   |   |   |
| 1704 | 80% gamma percentile (KM)                                                                                                 |   |   | 1465     | 90% gamma percentile (KM)                            |   |                             | 4456  |   |   |   |   |
| 1705 | 95% gamma percentile (KM)                                                                                                 |   |   | 8722     | 99% gamma percentile (KM)                            |   |                             | 21515 |   |   |   |   |
| 1706 |                                                                                                                           |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1707 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1708 | Approximate Chi Square Value (38.74, $\alpha$ )                                                                           |   |   | 25.48    | Adjusted Chi Square Value (38.74, $\beta$ )          |   |                             | 25.38 |   |   |   |   |
| 1709 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   |   | 2347     | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )       |   |                             | 2357  |   |   |   |   |
| 1710 |                                                                                                                           |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1711 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1712 | Shapiro Wilk Approximate Test Statistic                                                                                   |   |   | 0.801    | <b>Shapiro Wilk GOF Test</b>                         |   |                             |       |   |   |   |   |
| 1713 | 5% Shapiro Wilk P Value                                                                                                   |   |   | 0        | Detected Data Not Lognormal at 5% Significance Level |   |                             |       |   |   |   |   |
| 1714 | Lilliefors Test Statistic                                                                                                 |   |   | 0.231    | <b>Lilliefors GOF Test</b>                           |   |                             |       |   |   |   |   |
| 1715 | 5% Lilliefors Critical Value                                                                                              |   |   | 0.0907   | Detected Data Not Lognormal at 5% Significance Level |   |                             |       |   |   |   |   |
| 1716 | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                               |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1717 |                                                                                                                           |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1718 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1719 | Mean in Original Scale                                                                                                    |   |   | 1550     | Mean in Log Scale                                    |   |                             | 4.85  |   |   |   |   |
| 1720 | SD in Original Scale                                                                                                      |   |   | 4342     | SD in Log Scale                                      |   |                             | 2.349 |   |   |   |   |
| 1721 | 95% t UCL (assumes normality of ROS data)                                                                                 |   |   | 2137     | 95% Percentile Bootstrap UCL                         |   |                             | 2170  |   |   |   |   |
| 1722 | 95% BCA Bootstrap UCL                                                                                                     |   |   | 2237     | 95% Bootstrap t UCL                                  |   |                             | 2313  |   |   |   |   |
| 1723 | 95% H-UCL (Log ROS)                                                                                                       |   |   | 4131     |                                                      |   |                             |       |   |   |   |   |
| 1724 |                                                                                                                           |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1725 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1726 | KM Mean (logged)                                                                                                          |   |   | 4.25     | KM Geo Mean                                          |   |                             | 70.08 |   |   |   |   |
| 1727 | KM SD (logged)                                                                                                            |   |   | 2.925    | 95% Critical H Value (KM-Log)                        |   |                             | 4.468 |   |   |   |   |
| 1728 | KM Standard Error of Mean (logged)                                                                                        |   |   | 0.24     | 95% H-UCL (KM -Log)                                  |   |                             | 14727 |   |   |   |   |
| 1729 | KM SD (logged)                                                                                                            |   |   | 2.925    | 95% Critical H Value (KM-Log)                        |   |                             | 4.468 |   |   |   |   |
| 1730 | KM Standard Error of Mean (logged)                                                                                        |   |   | 0.24     |                                                      |   |                             |       |   |   |   |   |
| 1731 |                                                                                                                           |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1732 | <b>DL/2 Statistics</b>                                                                                                    |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1733 | <b>DL/2 Normal</b>                                                                                                        |   |   |          |                                                      |   | <b>DL/2 Log-Transformed</b> |       |   |   |   |   |
| 1734 | Mean in Original Scale                                                                                                    |   |   | 1560     | Mean in Log Scale                                    |   |                             | 5.288 |   |   |   |   |
| 1735 | SD in Original Scale                                                                                                      |   |   | 4338     | SD in Log Scale                                      |   |                             | 1.892 |   |   |   |   |
| 1736 | 95% t UCL (Assumes normality)                                                                                             |   |   | 2146     | 95% H-Stat UCL                                       |   |                             | 1936  |   |   |   |   |
| 1737 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                  |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1738 |                                                                                                                           |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1739 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                     |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1740 | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                             |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1741 |                                                                                                                           |   |   |          |                                                      |   |                             |       |   |   |   |   |
| 1742 | <b>Suggested UCL to Use</b>                                                                                               |   |   |          |                                                      |   |                             |       |   |   |   |   |

| A    | B                                                                                                                                        | C | D | E      | F | G                                                            | H | I | J      | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|---|--------------------------------------------------------------|---|---|--------|---|---|
| 1743 | 95% KM (Chebyshev) UCL                                                                                                                   |   |   | 3093   |   |                                                              |   |   |        |   |   |
| 1744 |                                                                                                                                          |   |   |        |   |                                                              |   |   |        |   |   |
| 1745 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |   |                                                              |   |   |        |   |   |
| 1746 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |   |                                                              |   |   |        |   |   |
| 1747 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |   |                                                              |   |   |        |   |   |
| 1748 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |   |                                                              |   |   |        |   |   |
| 1749 |                                                                                                                                          |   |   |        |   |                                                              |   |   |        |   |   |
| 1750 | <b>Result (eu7_lead)</b>                                                                                                                 |   |   |        |   |                                                              |   |   |        |   |   |
| 1751 |                                                                                                                                          |   |   |        |   |                                                              |   |   |        |   |   |
| 1752 | <b>General Statistics</b>                                                                                                                |   |   |        |   |                                                              |   |   |        |   |   |
| 1753 | Total Number of Observations                                                                                                             |   |   | 152    |   | Number of Distinct Observations                              |   |   | 128    |   |   |
| 1754 | Number of Detects                                                                                                                        |   |   | 132    |   | Number of Non-Detects                                        |   |   | 20     |   |   |
| 1755 | Number of Distinct Detects                                                                                                               |   |   | 126    |   | Number of Distinct Non-Detects                               |   |   | 2      |   |   |
| 1756 | Minimum Detect                                                                                                                           |   |   | 0.601  |   | Minimum Non-Detect                                           |   |   | 0.03   |   |   |
| 1757 | Maximum Detect                                                                                                                           |   |   | 286    |   | Maximum Non-Detect                                           |   |   | 0.5    |   |   |
| 1758 | Variance Detects                                                                                                                         |   |   | 1245   |   | Percent Non-Detects                                          |   |   | 13.16% |   |   |
| 1759 | Mean Detects                                                                                                                             |   |   | 11.07  |   | SD Detects                                                   |   |   | 35.28  |   |   |
| 1760 | Median Detects                                                                                                                           |   |   | 2.89   |   | CV Detects                                                   |   |   | 3.188  |   |   |
| 1761 | Skewness Detects                                                                                                                         |   |   | 6.43   |   | Kurtosis Detects                                             |   |   | 43.06  |   |   |
| 1762 | Mean of Logged Detects                                                                                                                   |   |   | 1.331  |   | SD of Logged Detects                                         |   |   | 1.179  |   |   |
| 1763 |                                                                                                                                          |   |   |        |   |                                                              |   |   |        |   |   |
| 1764 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |   |        |   |                                                              |   |   |        |   |   |
| 1765 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.283  |   | <b>Normal GOF Test on Detected Observations Only</b>         |   |   |        |   |   |
| 1766 | 5% Shapiro Wilk P Value                                                                                                                  |   |   | 0      |   | Detected Data Not Normal at 5% Significance Level            |   |   |        |   |   |
| 1767 | Lilliefors Test Statistic                                                                                                                |   |   | 0.383  |   | <b>Lilliefors GOF Test</b>                                   |   |   |        |   |   |
| 1768 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.0775 |   | Detected Data Not Normal at 5% Significance Level            |   |   |        |   |   |
| 1769 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |   |   |        |   |                                                              |   |   |        |   |   |
| 1770 |                                                                                                                                          |   |   |        |   |                                                              |   |   |        |   |   |
| 1771 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |   |        |   |                                                              |   |   |        |   |   |
| 1772 | KM Mean                                                                                                                                  |   |   | 9.614  |   | KM Standard Error of Mean                                    |   |   | 2.684  |   |   |
| 1773 | KM SD                                                                                                                                    |   |   | 32.97  |   | 95% KM (BCA) UCL                                             |   |   | 14.37  |   |   |
| 1774 | 95% KM (t) UCL                                                                                                                           |   |   | 14.06  |   | 95% KM (Percentile Bootstrap) UCL                            |   |   | 14.4   |   |   |
| 1775 | 95% KM (z) UCL                                                                                                                           |   |   | 14.03  |   | 95% KM Bootstrap t UCL                                       |   |   | 18.81  |   |   |
| 1776 | 90% KM Chebyshev UCL                                                                                                                     |   |   | 17.67  |   | 95% KM Chebyshev UCL                                         |   |   | 21.31  |   |   |
| 1777 | 97.5% KM Chebyshev UCL                                                                                                                   |   |   | 26.38  |   | 99% KM Chebyshev UCL                                         |   |   | 36.32  |   |   |
| 1778 |                                                                                                                                          |   |   |        |   |                                                              |   |   |        |   |   |
| 1779 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |   |   |        |   |                                                              |   |   |        |   |   |
| 1780 | A-D Test Statistic                                                                                                                       |   |   | 10.89  |   | <b>Anderson-Darling GOF Test</b>                             |   |   |        |   |   |
| 1781 | 5% A-D Critical Value                                                                                                                    |   |   | 0.812  |   | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |        |   |   |
| 1782 | K-S Test Statistic                                                                                                                       |   |   | 0.203  |   | <b>Kolmogorov-Smirnov GOF</b>                                |   |   |        |   |   |
| 1783 | 5% K-S Critical Value                                                                                                                    |   |   | 0.0854 |   | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |        |   |   |
| 1784 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                                      |   |   |        |   |                                                              |   |   |        |   |   |
| 1785 |                                                                                                                                          |   |   |        |   |                                                              |   |   |        |   |   |
| 1786 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |   |   |        |   |                                                              |   |   |        |   |   |
| 1787 | k hat (MLE)                                                                                                                              |   |   | 0.579  |   | k star (bias corrected MLE)                                  |   |   | 0.571  |   |   |
| 1788 | Theta hat (MLE)                                                                                                                          |   |   | 19.11  |   | Theta star (bias corrected MLE)                              |   |   | 19.38  |   |   |
| 1789 | nu hat (MLE)                                                                                                                             |   |   | 152.9  |   | nu star (bias corrected)                                     |   |   | 150.7  |   |   |
| 1790 | Mean (detects)                                                                                                                           |   |   | 11.07  |   |                                                              |   |   |        |   |   |
| 1791 |                                                                                                                                          |   |   |        |   |                                                              |   |   |        |   |   |
| 1792 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |   |   |        |   |                                                              |   |   |        |   |   |
| 1793 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |   |   |        |   |                                                              |   |   |        |   |   |
| 1794 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |   |   |        |   |                                                              |   |   |        |   |   |
| 1795 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |   |   |        |   |                                                              |   |   |        |   |   |
| 1796 | This is especially true when the sample size is small.                                                                                   |   |   |        |   |                                                              |   |   |        |   |   |
| 1797 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |   |   |        |   |                                                              |   |   |        |   |   |
| 1798 | Minimum                                                                                                                                  |   |   | 0.01   |   | Mean                                                         |   |   | 9.612  |   |   |
| 1799 | Maximum                                                                                                                                  |   |   | 286    |   | Median                                                       |   |   | 2.695  |   |   |
| 1800 | SD                                                                                                                                       |   |   | 33.07  |   | CV                                                           |   |   | 3.441  |   |   |
| 1801 | k hat (MLE)                                                                                                                              |   |   | 0.386  |   | k star (bias corrected MLE)                                  |   |   | 0.383  |   |   |
| 1802 | Theta hat (MLE)                                                                                                                          |   |   | 24.88  |   | Theta star (bias corrected MLE)                              |   |   | 25.09  |   |   |
| 1803 | nu hat (MLE)                                                                                                                             |   |   | 117.4  |   | nu star (bias corrected)                                     |   |   | 116.5  |   |   |
| 1804 | Adjusted Level of Significance ( $\beta$ )                                                                                               |   |   | 0.0484 |   |                                                              |   |   |        |   |   |
| 1805 | Approximate Chi Square Value (116.46, $\alpha$ )                                                                                         |   |   | 92.55  |   | Adjusted Chi Square Value (116.46, $\beta$ )                 |   |   | 92.34  |   |   |
| 1806 | 95% Gamma Approximate UCL (use when n>=50)                                                                                               |   |   | 12.1   |   | 95% Gamma Adjusted UCL (use when n<50)                       |   |   | 12.12  |   |   |
| 1807 |                                                                                                                                          |   |   |        |   |                                                              |   |   |        |   |   |
| 1808 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |   |   |        |   |                                                              |   |   |        |   |   |
| 1809 | Mean (KM)                                                                                                                                |   |   | 9.614  |   | SD (KM)                                                      |   |   | 32.97  |   |   |

| A    | B | C | D | E                                                                                                                                               | F         | G | H | I                           | J | K                                                    | L      |
|------|---|---|---|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---|---|-----------------------------|---|------------------------------------------------------|--------|
| 1810 |   |   |   | Variance (KM)                                                                                                                                   | 1087      |   |   |                             |   | SE of Mean (KM)                                      | 2.684  |
| 1811 |   |   |   | k hat (KM)                                                                                                                                      | 0.0851    |   |   |                             |   | k star (KM)                                          | 0.0878 |
| 1812 |   |   |   | nu hat (KM)                                                                                                                                     | 25.86     |   |   |                             |   | nu star (KM)                                         | 26.68  |
| 1813 |   |   |   | theta hat (KM)                                                                                                                                  | 113       |   |   |                             |   | theta star (KM)                                      | 109.5  |
| 1814 |   |   |   | 80% gamma percentile (KM)                                                                                                                       | 5.425     |   |   |                             |   | 90% gamma percentile (KM)                            | 24.06  |
| 1815 |   |   |   | 95% gamma percentile (KM)                                                                                                                       | 56.02     |   |   |                             |   | 99% gamma percentile (KM)                            | 162.9  |
| 1816 |   |   |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                       |           |   |   |                             |   |                                                      |        |
| 1817 |   |   |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                       |           |   |   |                             |   |                                                      |        |
| 1818 |   |   |   | Approximate Chi Square Value (26.68, $\alpha$ )                                                                                                 | 15.91     |   |   |                             |   | Adjusted Chi Square Value (26.68, $\beta$ )          | 15.83  |
| 1819 |   |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                             | 16.13     |   |   |                             |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )       | 16.21  |
| 1820 |   |   |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                         |           |   |   |                             |   |                                                      |        |
| 1821 |   |   |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                         |           |   |   |                             |   |                                                      |        |
| 1822 |   |   |   | Shapiro Wilk Approximate Test Statistic                                                                                                         | 0.922     |   |   |                             |   | <b>Shapiro Wilk GOF Test</b>                         |        |
| 1823 |   |   |   | 5% Shapiro Wilk P Value                                                                                                                         | 1.2169E-8 |   |   |                             |   | Detected Data Not Lognormal at 5% Significance Level |        |
| 1824 |   |   |   | Lilliefors Test Statistic                                                                                                                       | 0.103     |   |   |                             |   | <b>Lilliefors GOF Test</b>                           |        |
| 1825 |   |   |   | 5% Lilliefors Critical Value                                                                                                                    | 0.0775    |   |   |                             |   | Detected Data Not Lognormal at 5% Significance Level |        |
| 1826 |   |   |   | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                                                     |           |   |   |                             |   |                                                      |        |
| 1827 |   |   |   | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                                                     |           |   |   |                             |   |                                                      |        |
| 1828 |   |   |   | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                       |           |   |   |                             |   |                                                      |        |
| 1829 |   |   |   | Mean in Original Scale                                                                                                                          | 9.649     |   |   |                             |   | Mean in Log Scale                                    | 0.982  |
| 1830 |   |   |   | SD in Original Scale                                                                                                                            | 33.06     |   |   |                             |   | SD in Log Scale                                      | 1.431  |
| 1831 |   |   |   | 95% t UCL (assumes normality of ROS data)                                                                                                       | 14.09     |   |   |                             |   | 95% Percentile Bootstrap UCL                         | 14.53  |
| 1832 |   |   |   | 95% BCA Bootstrap UCL                                                                                                                           | 15.64     |   |   |                             |   | 95% Bootstrap t UCL                                  | 24.49  |
| 1833 |   |   |   | 95% H-UCL (Log ROS)                                                                                                                             | 10.1      |   |   |                             |   |                                                      |        |
| 1834 |   |   |   | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                         |           |   |   |                             |   |                                                      |        |
| 1835 |   |   |   | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                         |           |   |   |                             |   |                                                      |        |
| 1836 |   |   |   | KM Mean (logged)                                                                                                                                | 0.695     |   |   |                             |   | KM Geo Mean                                          | 2.003  |
| 1837 |   |   |   | KM SD (logged)                                                                                                                                  | 1.968     |   |   |                             |   | 95% Critical H Value (KM-Log)                        | 3.258  |
| 1838 |   |   |   | KM Standard Error of Mean (logged)                                                                                                              | 0.16      |   |   |                             |   | 95% H-UCL (KM -Log)                                  | 23.39  |
| 1839 |   |   |   | KM SD (logged)                                                                                                                                  | 1.968     |   |   |                             |   | 95% Critical H Value (KM-Log)                        | 3.258  |
| 1840 |   |   |   | KM Standard Error of Mean (logged)                                                                                                              | 0.16      |   |   |                             |   |                                                      |        |
| 1841 |   |   |   | <b>DL/2 Statistics</b>                                                                                                                          |           |   |   |                             |   |                                                      |        |
| 1842 |   |   |   | <b>DL/2 Statistics</b>                                                                                                                          |           |   |   |                             |   |                                                      |        |
| 1843 |   |   |   | <b>DL/2 Normal</b>                                                                                                                              |           |   |   | <b>DL/2 Log-Transformed</b> |   |                                                      |        |
| 1844 |   |   |   | Mean in Original Scale                                                                                                                          | 9.637     |   |   |                             |   | Mean in Log Scale                                    | 0.9    |
| 1845 |   |   |   | SD in Original Scale                                                                                                                            | 33.07     |   |   |                             |   | SD in Log Scale                                      | 1.616  |
| 1846 |   |   |   | 95% t UCL (Assumes normality)                                                                                                                   | 14.08     |   |   |                             |   | 95% H-Stat UCL                                       | 13.18  |
| 1847 |   |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                        |           |   |   |                             |   |                                                      |        |
| 1848 |   |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                        |           |   |   |                             |   |                                                      |        |
| 1849 |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                           |           |   |   |                             |   |                                                      |        |
| 1850 |   |   |   | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                                   |           |   |   |                             |   |                                                      |        |
| 1851 |   |   |   | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                                   |           |   |   |                             |   |                                                      |        |
| 1852 |   |   |   | <b>Suggested UCL to Use</b>                                                                                                                     |           |   |   |                             |   |                                                      |        |
| 1853 |   |   |   | 95% KM (Chebyshev) UCL                                                                                                                          | 21.31     |   |   |                             |   |                                                      |        |
| 1854 |   |   |   | <b>Suggested UCL to Use</b>                                                                                                                     |           |   |   |                             |   |                                                      |        |
| 1855 |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.                    |           |   |   |                             |   |                                                      |        |
| 1856 |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                                      |           |   |   |                             |   |                                                      |        |
| 1857 |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                        |           |   |   |                             |   |                                                      |        |
| 1858 |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician        |           |   |   |                             |   |                                                      |        |
| 1859 |   |   |   | <b>however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician</b> |           |   |   |                             |   |                                                      |        |
| 1860 |   |   |   | <b>Result (eu7_manganese)</b>                                                                                                                   |           |   |   |                             |   |                                                      |        |
| 1861 |   |   |   | <b>Result (eu7_manganese)</b>                                                                                                                   |           |   |   |                             |   |                                                      |        |
| 1862 |   |   |   | <b>General Statistics</b>                                                                                                                       |           |   |   |                             |   |                                                      |        |
| 1863 |   |   |   | Total Number of Observations                                                                                                                    | 152       |   |   |                             |   | Number of Distinct Observations                      | 130    |
| 1864 |   |   |   | Number of Detects                                                                                                                               | 141       |   |   |                             |   | Number of Non-Detects                                | 11     |
| 1865 |   |   |   | Number of Distinct Detects                                                                                                                      | 129       |   |   |                             |   | Number of Distinct Non-Detects                       | 1      |
| 1866 |   |   |   | Minimum Detect                                                                                                                                  | 2.05      |   |   |                             |   | Minimum Non-Detect                                   | 2      |
| 1867 |   |   |   | Maximum Detect                                                                                                                                  | 5840      |   |   |                             |   | Maximum Non-Detect                                   | 2      |
| 1868 |   |   |   | Variance Detects                                                                                                                                | 1015815   |   |   |                             |   | Percent Non-Detects                                  | 7.237% |
| 1869 |   |   |   | Mean Detects                                                                                                                                    | 535.1     |   |   |                             |   | SD Detects                                           | 1008   |
| 1870 |   |   |   | Median Detects                                                                                                                                  | 296       |   |   |                             |   | CV Detects                                           | 1.883  |
| 1871 |   |   |   | Skewness Detects                                                                                                                                | 3.992     |   |   |                             |   | Kurtosis Detects                                     | 15.91  |
| 1872 |   |   |   | Mean of Logged Detects                                                                                                                          | 5.321     |   |   |                             |   | SD of Logged Detects                                 | 1.659  |
| 1873 |   |   |   | <b>Normal GOF Test on Detects Only</b>                                                                                                          |           |   |   |                             |   |                                                      |        |
| 1874 |   |   |   | <b>Normal GOF Test on Detects Only</b>                                                                                                          |           |   |   |                             |   |                                                      |        |
| 1875 |   |   |   | Shapiro Wilk Test Statistic                                                                                                                     | 0.442     |   |   |                             |   | <b>Normal GOF Test on Detected Observations Only</b> |        |
| 1876 |   |   |   | 5% Shapiro Wilk P Value                                                                                                                         | 0         |   |   |                             |   | Detected Data Not Normal at 5% Significance Level    |        |

|      | A                                                                                                                         | B | C | D      | E                                                            | F                                                 | G | H     | I | J | K | L |  |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|--------|--------------------------------------------------------------|---------------------------------------------------|---|-------|---|---|---|---|--|
| 1877 | Lilliefors Test Statistic                                                                                                 |   |   |        | 0.363                                                        | Lilliefors GOF Test                               |   |       |   |   |   |   |  |
| 1878 | 5% Lilliefors Critical Value                                                                                              |   |   |        | 0.075                                                        | Detected Data Not Normal at 5% Significance Level |   |       |   |   |   |   |  |
| 1879 | Detected Data Not Normal at 5% Significance Level                                                                         |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1880 |                                                                                                                           |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1881 | Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs                                    |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1882 | KM Mean                                                                                                                   |   |   | 496.5  | KM Standard Error of Mean                                    |                                                   |   | 79.53 |   |   |   |   |  |
| 1883 | KM SD                                                                                                                     |   |   | 977.1  | 95% KM (BCA) UCL                                             |                                                   |   | 650.4 |   |   |   |   |  |
| 1884 | 95% KM (t) UCL                                                                                                            |   |   | 628.2  | 95% KM (Percentile Bootstrap) UCL                            |                                                   |   | 635.9 |   |   |   |   |  |
| 1885 | 95% KM (z) UCL                                                                                                            |   |   | 627.4  | 95% KM Bootstrap t UCL                                       |                                                   |   | 675.2 |   |   |   |   |  |
| 1886 | 90% KM Chebyshev UCL                                                                                                      |   |   | 735.1  | 95% KM Chebyshev UCL                                         |                                                   |   | 843.2 |   |   |   |   |  |
| 1887 | 97.5% KM Chebyshev UCL                                                                                                    |   |   | 993.2  | 99% KM Chebyshev UCL                                         |                                                   |   | 1288  |   |   |   |   |  |
| 1888 |                                                                                                                           |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1889 | Gamma GOF Tests on Detected Observations Only                                                                             |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1890 | A-D Test Statistic                                                                                                        |   |   | 8.116  | Anderson-Darling GOF Test                                    |                                                   |   |       |   |   |   |   |  |
| 1891 | 5% A-D Critical Value                                                                                                     |   |   | 0.806  | Detected Data Not Gamma Distributed at 5% Significance Level |                                                   |   |       |   |   |   |   |  |
| 1892 | K-S Test Statistic                                                                                                        |   |   | 0.206  | Kolmogorov-Smirnov GOF                                       |                                                   |   |       |   |   |   |   |  |
| 1893 | 5% K-S Critical Value                                                                                                     |   |   | 0.0826 | Detected Data Not Gamma Distributed at 5% Significance Level |                                                   |   |       |   |   |   |   |  |
| 1894 | Detected Data Not Gamma Distributed at 5% Significance Level                                                              |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1895 |                                                                                                                           |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1896 | Gamma Statistics on Detected Data Only                                                                                    |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1897 | k hat (MLE)                                                                                                               |   |   | 0.637  | k star (bias corrected MLE)                                  |                                                   |   | 0.628 |   |   |   |   |  |
| 1898 | Theta hat (MLE)                                                                                                           |   |   | 840    | Theta star (bias corrected MLE)                              |                                                   |   | 851.8 |   |   |   |   |  |
| 1899 | nu hat (MLE)                                                                                                              |   |   | 179.6  | nu star (bias corrected)                                     |                                                   |   | 177.1 |   |   |   |   |  |
| 1900 | Mean (detects)                                                                                                            |   |   | 535.1  |                                                              |                                                   |   |       |   |   |   |   |  |
| 1901 |                                                                                                                           |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1902 | Gamma ROS Statistics using Imputed Non-Detects                                                                            |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1903 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1904 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1905 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1906 | This is especially true when the sample size is small.                                                                    |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1907 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1908 | Minimum                                                                                                                   |   |   | 0.01   | Mean                                                         |                                                   |   | 496.4 |   |   |   |   |  |
| 1909 | Maximum                                                                                                                   |   |   | 5840   | Median                                                       |                                                   |   | 280.5 |   |   |   |   |  |
| 1910 | SD                                                                                                                        |   |   | 980.4  | CV                                                           |                                                   |   | 1.975 |   |   |   |   |  |
| 1911 | k hat (MLE)                                                                                                               |   |   | 0.409  | k star (bias corrected MLE)                                  |                                                   |   | 0.405 |   |   |   |   |  |
| 1912 | Theta hat (MLE)                                                                                                           |   |   | 1215   | Theta star (bias corrected MLE)                              |                                                   |   | 1226  |   |   |   |   |  |
| 1913 | nu hat (MLE)                                                                                                              |   |   | 124.2  | nu star (bias corrected)                                     |                                                   |   | 123.1 |   |   |   |   |  |
| 1914 | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   | 0.0484 |                                                              |                                                   |   |       |   |   |   |   |  |
| 1915 | Approximate Chi Square Value (123.11, $\alpha$ )                                                                          |   |   | 98.49  | Adjusted Chi Square Value (123.11, $\beta$ )                 |                                                   |   | 98.28 |   |   |   |   |  |
| 1916 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   | 620.5  | 95% Gamma Adjusted UCL (use when $n < 50$ )                  |                                                   |   | 621.8 |   |   |   |   |  |
| 1917 |                                                                                                                           |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1918 | Estimates of Gamma Parameters using KM Estimates                                                                          |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1919 | Mean (KM)                                                                                                                 |   |   | 496.5  | SD (KM)                                                      |                                                   |   | 977.1 |   |   |   |   |  |
| 1920 | Variance (KM)                                                                                                             |   |   | 954698 | SE of Mean (KM)                                              |                                                   |   | 79.53 |   |   |   |   |  |
| 1921 | k hat (KM)                                                                                                                |   |   | 0.258  | k star (KM)                                                  |                                                   |   | 0.258 |   |   |   |   |  |
| 1922 | nu hat (KM)                                                                                                               |   |   | 78.51  | nu star (KM)                                                 |                                                   |   | 78.29 |   |   |   |   |  |
| 1923 | theta hat (KM)                                                                                                            |   |   | 1923   | theta star (KM)                                              |                                                   |   | 1928  |   |   |   |   |  |
| 1924 | 80% gamma percentile (KM)                                                                                                 |   |   | 728.6  | 90% gamma percentile (KM)                                    |                                                   |   | 1487  |   |   |   |   |  |
| 1925 | 95% gamma percentile (KM)                                                                                                 |   |   | 2382   | 99% gamma percentile (KM)                                    |                                                   |   | 4755  |   |   |   |   |  |
| 1926 |                                                                                                                           |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1927 | Gamma Kaplan-Meier (KM) Statistics                                                                                        |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1928 | Approximate Chi Square Value (78.29, $\alpha$ )                                                                           |   |   | 58.9   | Adjusted Chi Square Value (78.29, $\beta$ )                  |                                                   |   | 58.74 |   |   |   |   |  |
| 1929 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   |   | 659.9  | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )               |                                                   |   | 661.7 |   |   |   |   |  |
| 1930 |                                                                                                                           |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1931 | Lognormal GOF Test on Detected Observations Only                                                                          |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1932 | Shapiro Wilk Approximate Test Statistic                                                                                   |   |   | 0.823  | Shapiro Wilk GOF Test                                        |                                                   |   |       |   |   |   |   |  |
| 1933 | 5% Shapiro Wilk P Value                                                                                                   |   |   | 0      | Detected Data Not Lognormal at 5% Significance Level         |                                                   |   |       |   |   |   |   |  |
| 1934 | Lilliefors Test Statistic                                                                                                 |   |   | 0.245  | Lilliefors GOF Test                                          |                                                   |   |       |   |   |   |   |  |
| 1935 | 5% Lilliefors Critical Value                                                                                              |   |   | 0.075  | Detected Data Not Lognormal at 5% Significance Level         |                                                   |   |       |   |   |   |   |  |
| 1936 | Detected Data Not Lognormal at 5% Significance Level                                                                      |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1937 |                                                                                                                           |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1938 | Lognormal ROS Statistics Using Imputed Non-Detects                                                                        |   |   |        |                                                              |                                                   |   |       |   |   |   |   |  |
| 1939 | Mean in Original Scale                                                                                                    |   |   | 496.9  | Mean in Log Scale                                            |                                                   |   | 5.073 |   |   |   |   |  |
| 1940 | SD in Original Scale                                                                                                      |   |   | 980.1  | SD in Log Scale                                              |                                                   |   | 1.833 |   |   |   |   |  |
| 1941 | 95% t UCL (assumes normality of ROS data)                                                                                 |   |   | 628.5  | 95% Percentile Bootstrap UCL                                 |                                                   |   | 629.7 |   |   |   |   |  |
| 1942 | 95% BCA Bootstrap UCL                                                                                                     |   |   | 662.8  | 95% Bootstrap t UCL                                          |                                                   |   | 667   |   |   |   |   |  |
| 1943 | 95% H-UCL (Log ROS)                                                                                                       |   |   | 1361   |                                                              |                                                   |   |       |   |   |   |   |  |

|      | A                                                                                                                                        | B | C                                          | D | E | F      | G                                       | H | I | J                                                               | K | L     |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|--------------------------------------------|---|---|--------|-----------------------------------------|---|---|-----------------------------------------------------------------|---|-------|
| 1944 |                                                                                                                                          |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1945 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1946 |                                                                                                                                          |   | KM Mean (logged)                           |   |   | 4.986  |                                         |   |   | KM Geo Mean                                                     |   | 146.4 |
| 1947 |                                                                                                                                          |   | KM SD (logged)                             |   |   | 1.993  |                                         |   |   | 95% Critical H Value (KM-Log)                                   |   | 3.289 |
| 1948 |                                                                                                                                          |   | KM Standard Error of Mean (logged)         |   |   | 0.162  |                                         |   |   | 95% H-UCL (KM -Log)                                             |   | 1818  |
| 1949 |                                                                                                                                          |   | KM SD (logged)                             |   |   | 1.993  |                                         |   |   | 95% Critical H Value (KM-Log)                                   |   | 3.289 |
| 1950 |                                                                                                                                          |   | KM Standard Error of Mean (logged)         |   |   | 0.162  |                                         |   |   |                                                                 |   |       |
| 1951 |                                                                                                                                          |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1952 | <b>DL/2 Statistics</b>                                                                                                                   |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1953 | <b>DL/2 Normal</b>                                                                                                                       |   |                                            |   |   |        | <b>DL/2 Log-Transformed</b>             |   |   |                                                                 |   |       |
| 1954 |                                                                                                                                          |   | Mean in Original Scale                     |   |   | 496.5  |                                         |   |   | Mean in Log Scale                                               |   | 4.936 |
| 1955 |                                                                                                                                          |   | SD in Original Scale                       |   |   | 980.4  |                                         |   |   | SD in Log Scale                                                 |   | 2.113 |
| 1956 |                                                                                                                                          |   | 95% t UCL (Assumes normality)              |   |   | 628.1  |                                         |   |   | 95% H-Stat UCL                                                  |   | 2342  |
| 1957 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1958 |                                                                                                                                          |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1959 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1960 | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                            |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1961 |                                                                                                                                          |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1962 | <b>Suggested UCL to Use</b>                                                                                                              |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1963 |                                                                                                                                          |   | 95% KM (Chebyshev) UCL                     |   |   | 843.2  |                                         |   |   |                                                                 |   |       |
| 1964 |                                                                                                                                          |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1965 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1966 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1967 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1968 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1969 |                                                                                                                                          |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1970 |                                                                                                                                          |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1971 | <b>Result (eu7_strontium)</b>                                                                                                            |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1972 |                                                                                                                                          |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1973 | <b>General Statistics</b>                                                                                                                |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1974 |                                                                                                                                          |   | Total Number of Observations               |   |   | 67     |                                         |   |   | Number of Distinct Observations                                 |   | 65    |
| 1975 |                                                                                                                                          |   |                                            |   |   |        |                                         |   |   | Number of Missing Observations                                  |   | 0     |
| 1976 |                                                                                                                                          |   | Minimum                                    |   |   | 95.4   |                                         |   |   | Mean                                                            |   | 426.4 |
| 1977 |                                                                                                                                          |   | Maximum                                    |   |   | 2100   |                                         |   |   | Median                                                          |   | 366   |
| 1978 |                                                                                                                                          |   | SD                                         |   |   | 364.1  |                                         |   |   | Std. Error of Mean                                              |   | 44.48 |
| 1979 |                                                                                                                                          |   | Coefficient of Variation                   |   |   | 0.854  |                                         |   |   | Skewness                                                        |   | 2.936 |
| 1980 |                                                                                                                                          |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1981 | <b>Normal GOF Test</b>                                                                                                                   |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1982 |                                                                                                                                          |   | Shapiro Wilk Test Statistic                |   |   | 0.705  |                                         |   |   | <b>Shapiro Wilk GOF Test</b>                                    |   |       |
| 1983 |                                                                                                                                          |   | 5% Shapiro Wilk P Value                    |   |   | 0      |                                         |   |   | Data Not Normal at 5% Significance Level                        |   |       |
| 1984 |                                                                                                                                          |   | Lilliefors Test Statistic                  |   |   | 0.207  |                                         |   |   | <b>Lilliefors GOF Test</b>                                      |   |       |
| 1985 |                                                                                                                                          |   | 5% Lilliefors Critical Value               |   |   | 0.108  |                                         |   |   | Data Not Normal at 5% Significance Level                        |   |       |
| 1986 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1987 |                                                                                                                                          |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1988 | <b>Assuming Normal Distribution</b>                                                                                                      |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1989 | <b>95% Normal UCL</b>                                                                                                                    |   |                                            |   |   |        | <b>95% UCLs (Adjusted for Skewness)</b> |   |   |                                                                 |   |       |
| 1990 |                                                                                                                                          |   | 95% Student's-t UCL                        |   |   | 500.6  |                                         |   |   | 95% Adjusted-CLT UCL (Chen-1995)                                |   | 516.7 |
| 1991 |                                                                                                                                          |   |                                            |   |   |        |                                         |   |   | 95% Modified-t UCL (Johnson-1978)                               |   | 503.3 |
| 1992 |                                                                                                                                          |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1993 | <b>Gamma GOF Test</b>                                                                                                                    |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1994 |                                                                                                                                          |   | A-D Test Statistic                         |   |   | 1.142  |                                         |   |   | <b>Anderson-Darling Gamma GOF Test</b>                          |   |       |
| 1995 |                                                                                                                                          |   | 5% A-D Critical Value                      |   |   | 0.762  |                                         |   |   | Data Not Gamma Distributed at 5% Significance Level             |   |       |
| 1996 |                                                                                                                                          |   | K-S Test Statistic                         |   |   | 0.107  |                                         |   |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>                        |   |       |
| 1997 |                                                                                                                                          |   | 5% K-S Critical Value                      |   |   | 0.11   |                                         |   |   | Detected data appear Gamma Distributed at 5% Significance Level |   |       |
| 1998 | <b>Detected data follow Appr. Gamma Distribution at 5% Significance Level</b>                                                            |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 1999 |                                                                                                                                          |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 2000 | <b>Gamma Statistics</b>                                                                                                                  |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 2001 |                                                                                                                                          |   | k hat (MLE)                                |   |   | 2.212  |                                         |   |   | k star (bias corrected MLE)                                     |   | 2.123 |
| 2002 |                                                                                                                                          |   | Theta hat (MLE)                            |   |   | 192.8  |                                         |   |   | Theta star (bias corrected MLE)                                 |   | 200.9 |
| 2003 |                                                                                                                                          |   | nu hat (MLE)                               |   |   | 296.4  |                                         |   |   | nu star (bias corrected)                                        |   | 284.4 |
| 2004 |                                                                                                                                          |   | MLE Mean (bias corrected)                  |   |   | 426.4  |                                         |   |   | MLE Sd (bias corrected)                                         |   | 292.7 |
| 2005 |                                                                                                                                          |   |                                            |   |   |        |                                         |   |   | Approximate Chi Square Value (0.05)                             |   | 246.4 |
| 2006 |                                                                                                                                          |   | Adjusted Level of Significance             |   |   | 0.0464 |                                         |   |   | Adjusted Chi Square Value                                       |   | 245.6 |
| 2007 |                                                                                                                                          |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 2008 | <b>Assuming Gamma Distribution</b>                                                                                                       |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |
| 2009 |                                                                                                                                          |   | 95% Approximate Gamma UCL (use when n>=50) |   |   | 492.3  |                                         |   |   | 95% Adjusted Gamma UCL (use when n<50)                          |   | 493.9 |
| 2010 |                                                                                                                                          |   |                                            |   |   |        |                                         |   |   |                                                                 |   |       |

|      | A                                                                                                                                        | B | C | D      | E | F                                                 | G | H | I | J      | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|---|---------------------------------------------------|---|---|---|--------|---|---|--|
| 2011 | <b>Lognormal GOF Test</b>                                                                                                                |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2012 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.962  |   | <b>Shapiro Wilk Lognormal GOF Test</b>            |   |   |   |        |   |   |  |
| 2013 | 5% Shapiro Wilk P Value                                                                                                                  |   |   | 0.107  |   | Data appear Lognormal at 5% Significance Level    |   |   |   |        |   |   |  |
| 2014 | Lilliefors Test Statistic                                                                                                                |   |   | 0.0824 |   | <b>Lilliefors Lognormal GOF Test</b>              |   |   |   |        |   |   |  |
| 2015 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.108  |   | Data appear Lognormal at 5% Significance Level    |   |   |   |        |   |   |  |
| 2016 | <b>Data appear Lognormal at 5% Significance Level</b>                                                                                    |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2017 |                                                                                                                                          |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2018 | <b>Lognormal Statistics</b>                                                                                                              |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2019 | Minimum of Logged Data                                                                                                                   |   |   | 4.558  |   | Mean of logged Data                               |   |   |   | 5.813  |   |   |  |
| 2020 | Maximum of Logged Data                                                                                                                   |   |   | 7.65   |   | SD of logged Data                                 |   |   |   | 0.676  |   |   |  |
| 2021 |                                                                                                                                          |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2022 | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2023 | 95% H-UCL                                                                                                                                |   |   | 496.1  |   | 90% Chebyshev (MVUE) UCL                          |   |   |   | 531.8  |   |   |  |
| 2024 | 95% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 583.2  |   | 97.5% Chebyshev (MVUE) UCL                        |   |   |   | 654.4  |   |   |  |
| 2025 | 99% Chebyshev (MVUE) UCL                                                                                                                 |   |   | 794.3  |   |                                                   |   |   |   |        |   |   |  |
| 2026 |                                                                                                                                          |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2027 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2028 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                         |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2029 |                                                                                                                                          |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2030 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2031 | 95% CLT UCL                                                                                                                              |   |   | 499.6  |   | 95% Jackknife UCL                                 |   |   |   | 500.6  |   |   |  |
| 2032 | 95% Standard Bootstrap UCL                                                                                                               |   |   | 499.4  |   | 95% Bootstrap-t UCL                               |   |   |   | 524.2  |   |   |  |
| 2033 | 95% Hall's Bootstrap UCL                                                                                                                 |   |   | 573.3  |   | 95% Percentile Bootstrap UCL                      |   |   |   | 504.1  |   |   |  |
| 2034 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 516.7  |   |                                                   |   |   |   |        |   |   |  |
| 2035 | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   |   | 559.9  |   | 95% Chebyshev(Mean, Sd) UCL                       |   |   |   | 620.3  |   |   |  |
| 2036 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   |   | 704.2  |   | 99% Chebyshev(Mean, Sd) UCL                       |   |   |   | 869    |   |   |  |
| 2037 |                                                                                                                                          |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2038 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2039 | 95% Approximate Gamma UCL                                                                                                                |   |   | 492.3  |   |                                                   |   |   |   |        |   |   |  |
| 2040 |                                                                                                                                          |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2041 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                           |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2042 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                   |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2043 |                                                                                                                                          |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2044 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2045 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2046 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2047 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2048 |                                                                                                                                          |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2049 | <b>Result (eu7_thallium)</b>                                                                                                             |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2050 |                                                                                                                                          |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2051 | <b>General Statistics</b>                                                                                                                |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2052 | Total Number of Observations                                                                                                             |   |   | 150    |   | Number of Distinct Observations                   |   |   |   | 28     |   |   |  |
| 2053 | Number of Detects                                                                                                                        |   |   | 25     |   | Number of Non-Detects                             |   |   |   | 125    |   |   |  |
| 2054 | Number of Distinct Detects                                                                                                               |   |   | 25     |   | Number of Distinct Non-Detects                    |   |   |   | 3      |   |   |  |
| 2055 | Minimum Detect                                                                                                                           |   |   | 5.81   |   | Minimum Non-Detect                                |   |   |   | 0.031  |   |   |  |
| 2056 | Maximum Detect                                                                                                                           |   |   | 28.3   |   | Maximum Non-Detect                                |   |   |   | 5      |   |   |  |
| 2057 | Variance Detects                                                                                                                         |   |   | 20.15  |   | Percent Non-Detects                               |   |   |   | 83.33% |   |   |  |
| 2058 | Mean Detects                                                                                                                             |   |   | 9.604  |   | SD Detects                                        |   |   |   | 4.489  |   |   |  |
| 2059 | Median Detects                                                                                                                           |   |   | 8.43   |   | CV Detects                                        |   |   |   | 0.467  |   |   |  |
| 2060 | Skewness Detects                                                                                                                         |   |   | 3.208  |   | Kurtosis Detects                                  |   |   |   | 12.86  |   |   |  |
| 2061 | Mean of Logged Detects                                                                                                                   |   |   | 2.195  |   | SD of Logged Detects                              |   |   |   | 0.343  |   |   |  |
| 2062 |                                                                                                                                          |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2063 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2064 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.665  |   | <b>Shapiro Wilk GOF Test</b>                      |   |   |   |        |   |   |  |
| 2065 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.918  |   | Detected Data Not Normal at 5% Significance Level |   |   |   |        |   |   |  |
| 2066 | Lilliefors Test Statistic                                                                                                                |   |   | 0.221  |   | <b>Lilliefors GOF Test</b>                        |   |   |   |        |   |   |  |
| 2067 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.173  |   | Detected Data Not Normal at 5% Significance Level |   |   |   |        |   |   |  |
| 2068 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2069 |                                                                                                                                          |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2070 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |   |        |   |                                                   |   |   |   |        |   |   |  |
| 2071 | KM Mean                                                                                                                                  |   |   | 1.627  |   | KM Standard Error of Mean                         |   |   |   | 0.333  |   |   |  |
| 2072 | KM SD                                                                                                                                    |   |   | 3.994  |   | 95% KM (BCA) UCL                                  |   |   |   | 2.19   |   |   |  |
| 2073 | 95% KM (t) UCL                                                                                                                           |   |   | 2.177  |   | 95% KM (Percentile Bootstrap) UCL                 |   |   |   | 2.195  |   |   |  |
| 2074 | 95% KM (z) UCL                                                                                                                           |   |   | 2.174  |   | 95% KM Bootstrap t UCL                            |   |   |   | 2.245  |   |   |  |
| 2075 | 90% KM Chebyshev UCL                                                                                                                     |   |   | 2.625  |   | 95% KM Chebyshev UCL                              |   |   |   | 3.077  |   |   |  |
| 2076 | 97.5% KM Chebyshev UCL                                                                                                                   |   |   | 3.705  |   | 99% KM Chebyshev UCL                              |   |   |   | 4.938  |   |   |  |
| 2077 |                                                                                                                                          |   |   |        |   |                                                   |   |   |   |        |   |   |  |

|      | A                                                                                                                         | B | C | D      | E                                                            | F | G                           | H      | I | J | K | L |  |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|--------|--------------------------------------------------------------|---|-----------------------------|--------|---|---|---|---|--|
| 2078 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2079 | A-D Test Statistic                                                                                                        |   |   | 1.038  | <b>Anderson-Darling GOF Test</b>                             |   |                             |        |   |   |   |   |  |
| 2080 | 5% A-D Critical Value                                                                                                     |   |   | 0.746  | Detected Data Not Gamma Distributed at 5% Significance Level |   |                             |        |   |   |   |   |  |
| 2081 | K-S Test Statistic                                                                                                        |   |   | 0.185  | <b>Kolmogorov-Smirnov GOF</b>                                |   |                             |        |   |   |   |   |  |
| 2082 | 5% K-S Critical Value                                                                                                     |   |   | 0.175  | Detected Data Not Gamma Distributed at 5% Significance Level |   |                             |        |   |   |   |   |  |
| 2083 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                       |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2084 |                                                                                                                           |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2085 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2086 | k hat (MLE)                                                                                                               |   |   | 7.578  | k star (bias corrected MLE)                                  |   |                             | 6.695  |   |   |   |   |  |
| 2087 | Theta hat (MLE)                                                                                                           |   |   | 1.267  | Theta star (bias corrected MLE)                              |   |                             | 1.435  |   |   |   |   |  |
| 2088 | nu hat (MLE)                                                                                                              |   |   | 378.9  | nu star (bias corrected)                                     |   |                             | 334.8  |   |   |   |   |  |
| 2089 | Mean (detects)                                                                                                            |   |   | 9.604  |                                                              |   |                             |        |   |   |   |   |  |
| 2090 |                                                                                                                           |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2091 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2092 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2093 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2094 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2095 | This is especially true when the sample size is small.                                                                    |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2096 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2097 | Minimum                                                                                                                   |   |   | 0.01   | Mean                                                         |   |                             | 1.98   |   |   |   |   |  |
| 2098 | Maximum                                                                                                                   |   |   | 28.3   | Median                                                       |   |                             | 0.01   |   |   |   |   |  |
| 2099 | SD                                                                                                                        |   |   | 3.981  | CV                                                           |   |                             | 2.011  |   |   |   |   |  |
| 2100 | k hat (MLE)                                                                                                               |   |   | 0.223  | k star (bias corrected MLE)                                  |   |                             | 0.223  |   |   |   |   |  |
| 2101 | Theta hat (MLE)                                                                                                           |   |   | 8.887  | Theta star (bias corrected MLE)                              |   |                             | 8.888  |   |   |   |   |  |
| 2102 | nu hat (MLE)                                                                                                              |   |   | 66.82  | nu star (bias corrected)                                     |   |                             | 66.82  |   |   |   |   |  |
| 2103 | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   | 0.0484 |                                                              |   |                             |        |   |   |   |   |  |
| 2104 | Approximate Chi Square Value (66.82, $\alpha$ )                                                                           |   |   | 49.01  | Adjusted Chi Square Value (66.82, $\beta$ )                  |   |                             | 48.86  |   |   |   |   |  |
| 2105 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   | 2.699  | 95% Gamma Adjusted UCL (use when $n < 50$ )                  |   |                             | 2.707  |   |   |   |   |  |
| 2106 |                                                                                                                           |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2107 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2108 | Mean (KM)                                                                                                                 |   |   | 1.627  | SD (KM)                                                      |   |                             | 3.994  |   |   |   |   |  |
| 2109 | Variance (KM)                                                                                                             |   |   | 15.95  | SE of Mean (KM)                                              |   |                             | 0.333  |   |   |   |   |  |
| 2110 | k hat (KM)                                                                                                                |   |   | 0.166  | k star (KM)                                                  |   |                             | 0.167  |   |   |   |   |  |
| 2111 | nu hat (KM)                                                                                                               |   |   | 49.75  | nu star (KM)                                                 |   |                             | 50.09  |   |   |   |   |  |
| 2112 | theta hat (KM)                                                                                                            |   |   | 9.808  | theta star (KM)                                              |   |                             | 9.742  |   |   |   |   |  |
| 2113 | 80% gamma percentile (KM)                                                                                                 |   |   | 1.92   | 90% gamma percentile (KM)                                    |   |                             | 4.881  |   |   |   |   |  |
| 2114 | 95% gamma percentile (KM)                                                                                                 |   |   | 8.755  | 99% gamma percentile (KM)                                    |   |                             | 19.76  |   |   |   |   |  |
| 2115 |                                                                                                                           |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2116 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2117 | Approximate Chi Square Value (50.09, $\alpha$ )                                                                           |   |   | 34.84  | Adjusted Chi Square Value (50.09, $\beta$ )                  |   |                             | 34.72  |   |   |   |   |  |
| 2118 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   |   | 2.339  | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )               |   |                             | 2.347  |   |   |   |   |  |
| 2119 |                                                                                                                           |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2120 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2121 | Shapiro Wilk Test Statistic                                                                                               |   |   | 0.881  | <b>Shapiro Wilk GOF Test</b>                                 |   |                             |        |   |   |   |   |  |
| 2122 | 5% Shapiro Wilk Critical Value                                                                                            |   |   | 0.918  | Detected Data Not Lognormal at 5% Significance Level         |   |                             |        |   |   |   |   |  |
| 2123 | Lilliefors Test Statistic                                                                                                 |   |   | 0.159  | <b>Lilliefors GOF Test</b>                                   |   |                             |        |   |   |   |   |  |
| 2124 | 5% Lilliefors Critical Value                                                                                              |   |   | 0.173  | Detected Data appear Lognormal at 5% Significance Level      |   |                             |        |   |   |   |   |  |
| 2125 | <b>Detected Data appear Approximate Lognormal at 5% Significance Level</b>                                                |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2126 |                                                                                                                           |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2127 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2128 | Mean in Original Scale                                                                                                    |   |   | 3.66   | Mean in Log Scale                                            |   |                             | 0.979  |   |   |   |   |  |
| 2129 | SD in Original Scale                                                                                                      |   |   | 3.447  | SD in Log Scale                                              |   |                             | 0.795  |   |   |   |   |  |
| 2130 | 95% t UCL (assumes normality of ROS data)                                                                                 |   |   | 4.126  | 95% Percentile Bootstrap UCL                                 |   |                             | 4.127  |   |   |   |   |  |
| 2131 | 95% BCA Bootstrap UCL                                                                                                     |   |   | 4.199  | 95% Bootstrap t UCL                                          |   |                             | 4.256  |   |   |   |   |  |
| 2132 | 95% H-UCL (Log ROS)                                                                                                       |   |   | 4.168  |                                                              |   |                             |        |   |   |   |   |  |
| 2133 |                                                                                                                           |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2134 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2135 | KM Mean (logged)                                                                                                          |   |   | -2.529 | KM Geo Mean                                                  |   |                             | 0.0797 |   |   |   |   |  |
| 2136 | KM SD (logged)                                                                                                            |   |   | 2.117  | 95% Critical H Value (KM-Log)                                |   |                             | 3.438  |   |   |   |   |  |
| 2137 | KM Standard Error of Mean (logged)                                                                                        |   |   | 0.176  | 95% H-UCL (KM -Log)                                          |   |                             | 1.361  |   |   |   |   |  |
| 2138 | KM SD (logged)                                                                                                            |   |   | 2.117  | 95% Critical H Value (KM-Log)                                |   |                             | 3.438  |   |   |   |   |  |
| 2139 | KM Standard Error of Mean (logged)                                                                                        |   |   | 0.176  |                                                              |   |                             |        |   |   |   |   |  |
| 2140 |                                                                                                                           |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2141 | <b>DL/2 Statistics</b>                                                                                                    |   |   |        |                                                              |   |                             |        |   |   |   |   |  |
| 2142 | <b>DL/2 Normal</b>                                                                                                        |   |   |        |                                                              |   | <b>DL/2 Log-Transformed</b> |        |   |   |   |   |  |
| 2143 | Mean in Original Scale                                                                                                    |   |   | 3.252  | Mean in Log Scale                                            |   |                             | 0.667  |   |   |   |   |  |
| 2144 | SD in Original Scale                                                                                                      |   |   | 3.446  | SD in Log Scale                                              |   |                             | 1.379  |   |   |   |   |  |

| A    | B                                                                                                                                        | C                             | D | E       | F | G                                                            | H | I | J | K      | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|---|---------|---|--------------------------------------------------------------|---|---|---|--------|---|
| 2145 |                                                                                                                                          | 95% t UCL (Assumes normality) |   | 3.717   |   | 95% H-Stat UCL                                               |   |   |   | 6.748  |   |
| 2146 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |                               |   |         |   |                                                              |   |   |   |        |   |
| 2147 |                                                                                                                                          |                               |   |         |   |                                                              |   |   |   |        |   |
| 2148 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |                               |   |         |   |                                                              |   |   |   |        |   |
| 2149 | <b>Detected Data appear Approximate Lognormal Distributed at 5% Significance Level</b>                                                   |                               |   |         |   |                                                              |   |   |   |        |   |
| 2150 |                                                                                                                                          |                               |   |         |   |                                                              |   |   |   |        |   |
| 2151 | <b>Suggested UCL to Use</b>                                                                                                              |                               |   |         |   |                                                              |   |   |   |        |   |
| 2152 |                                                                                                                                          | KM Student's t                |   | 0.0971  |   | KM H-UCL                                                     |   |   |   | 1.361  |   |
| 2153 |                                                                                                                                          |                               |   |         |   |                                                              |   |   |   |        |   |
| 2154 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |                               |   |         |   |                                                              |   |   |   |        |   |
| 2155 | Recommendations are based upon data size, data distribution, and skewness.                                                               |                               |   |         |   |                                                              |   |   |   |        |   |
| 2156 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |                               |   |         |   |                                                              |   |   |   |        |   |
| 2157 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |                               |   |         |   |                                                              |   |   |   |        |   |
| 2158 |                                                                                                                                          |                               |   |         |   |                                                              |   |   |   |        |   |
| 2159 | <b>Result (eu7_zinc)</b>                                                                                                                 |                               |   |         |   |                                                              |   |   |   |        |   |
| 2160 |                                                                                                                                          |                               |   |         |   |                                                              |   |   |   |        |   |
| 2161 | <b>General Statistics</b>                                                                                                                |                               |   |         |   |                                                              |   |   |   |        |   |
| 2162 |                                                                                                                                          | Total Number of Observations  |   | 152     |   | Number of Distinct Observations                              |   |   |   | 124    |   |
| 2163 |                                                                                                                                          | Number of Detects             |   | 151     |   | Number of Non-Detects                                        |   |   |   | 1      |   |
| 2164 |                                                                                                                                          | Number of Distinct Detects    |   | 123     |   | Number of Distinct Non-Detects                               |   |   |   | 1      |   |
| 2165 |                                                                                                                                          | Minimum Detect                |   | 11.9    |   | Minimum Non-Detect                                           |   |   |   | 10     |   |
| 2166 |                                                                                                                                          | Maximum Detect                |   | 12400   |   | Maximum Non-Detect                                           |   |   |   | 10     |   |
| 2167 |                                                                                                                                          | Variance Detects              |   | 3018501 |   | Percent Non-Detects                                          |   |   |   | 0.6589 |   |
| 2168 |                                                                                                                                          | Mean Detects                  |   | 575.2   |   | SD Detects                                                   |   |   |   | 1737   |   |
| 2169 |                                                                                                                                          | Median Detects                |   | 279     |   | CV Detects                                                   |   |   |   | 3.021  |   |
| 2170 |                                                                                                                                          | Skewness Detects              |   | 5.827   |   | Kurtosis Detects                                             |   |   |   | 34.11  |   |
| 2171 |                                                                                                                                          | Mean of Logged Detects        |   | 5.413   |   | SD of Logged Detects                                         |   |   |   | 1.15   |   |
| 2172 |                                                                                                                                          |                               |   |         |   |                                                              |   |   |   |        |   |
| 2173 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |                               |   |         |   |                                                              |   |   |   |        |   |
| 2174 |                                                                                                                                          | Shapiro Wilk Test Statistic   |   | 0.265   |   | <b>Normal GOF Test on Detected Observations Only</b>         |   |   |   |        |   |
| 2175 |                                                                                                                                          | 5% Shapiro Wilk P Value       |   | 0       |   | Detected Data Not Normal at 5% Significance Level            |   |   |   |        |   |
| 2176 |                                                                                                                                          | Lilliefors Test Statistic     |   | 0.434   |   | <b>Lilliefors GOF Test</b>                                   |   |   |   |        |   |
| 2177 |                                                                                                                                          | 5% Lilliefors Critical Value  |   | 0.0725  |   | Detected Data Not Normal at 5% Significance Level            |   |   |   |        |   |
| 2178 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |                               |   |         |   |                                                              |   |   |   |        |   |
| 2179 |                                                                                                                                          |                               |   |         |   |                                                              |   |   |   |        |   |
| 2180 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |                               |   |         |   |                                                              |   |   |   |        |   |
| 2181 |                                                                                                                                          | KM Mean                       |   | 571.5   |   | KM Standard Error of Mean                                    |   |   |   | 140.5  |   |
| 2182 |                                                                                                                                          | KM SD                         |   | 1727    |   | 95% KM (BCA) UCL                                             |   |   |   | 815    |   |
| 2183 |                                                                                                                                          | 95% KM (t) UCL                |   | 804     |   | 95% KM (Percentile Bootstrap) UCL                            |   |   |   | 818.8  |   |
| 2184 |                                                                                                                                          | 95% KM (z) UCL                |   | 802.6   |   | 95% KM Bootstrap t UCL                                       |   |   |   | 967.5  |   |
| 2185 |                                                                                                                                          | 90% KM Chebyshev UCL          |   | 993     |   | 95% KM Chebyshev UCL                                         |   |   |   | 1184   |   |
| 2186 |                                                                                                                                          | 97.5% KM Chebyshev UCL        |   | 1449    |   | 99% KM Chebyshev UCL                                         |   |   |   | 1969   |   |
| 2187 |                                                                                                                                          |                               |   |         |   |                                                              |   |   |   |        |   |
| 2188 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |                               |   |         |   |                                                              |   |   |   |        |   |
| 2189 |                                                                                                                                          | A-D Test Statistic            |   | 17.37   |   | <b>Anderson-Darling GOF Test</b>                             |   |   |   |        |   |
| 2190 |                                                                                                                                          | 5% A-D Critical Value         |   | 0.805   |   | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |   |        |   |
| 2191 |                                                                                                                                          | K-S Test Statistic            |   | 0.332   |   | <b>Kolmogorov-Smirnov GOF</b>                                |   |   |   |        |   |
| 2192 |                                                                                                                                          | 5% K-S Critical Value         |   | 0.0799  |   | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |   |        |   |
| 2193 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                                      |                               |   |         |   |                                                              |   |   |   |        |   |
| 2194 |                                                                                                                                          |                               |   |         |   |                                                              |   |   |   |        |   |
| 2195 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |                               |   |         |   |                                                              |   |   |   |        |   |
| 2196 |                                                                                                                                          | k hat (MLE)                   |   | 0.649   |   | k star (bias corrected MLE)                                  |   |   |   | 0.64   |   |
| 2197 |                                                                                                                                          | Theta hat (MLE)               |   | 886.4   |   | Theta star (bias corrected MLE)                              |   |   |   | 898.2  |   |
| 2198 |                                                                                                                                          | nu hat (MLE)                  |   | 196     |   | nu star (bias corrected)                                     |   |   |   | 193.4  |   |
| 2199 |                                                                                                                                          | Mean (detects)                |   | 575.2   |   |                                                              |   |   |   |        |   |
| 2200 |                                                                                                                                          |                               |   |         |   |                                                              |   |   |   |        |   |
| 2201 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |                               |   |         |   |                                                              |   |   |   |        |   |
| 2202 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |                               |   |         |   |                                                              |   |   |   |        |   |
| 2203 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |                               |   |         |   |                                                              |   |   |   |        |   |
| 2204 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |                               |   |         |   |                                                              |   |   |   |        |   |
| 2205 | This is especially true when the sample size is small.                                                                                   |                               |   |         |   |                                                              |   |   |   |        |   |
| 2206 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |                               |   |         |   |                                                              |   |   |   |        |   |
| 2207 |                                                                                                                                          | Minimum                       |   | 0.01    |   | Mean                                                         |   |   |   | 571.4  |   |
| 2208 |                                                                                                                                          | Maximum                       |   | 12400   |   | Median                                                       |   |   |   | 275.5  |   |
| 2209 |                                                                                                                                          | SD                            |   | 1732    |   | CV                                                           |   |   |   | 3.032  |   |
| 2210 |                                                                                                                                          | k hat (MLE)                   |   | 0.615   |   | k star (bias corrected MLE)                                  |   |   |   | 0.607  |   |
| 2211 |                                                                                                                                          | Theta hat (MLE)               |   | 928.9   |   | Theta star (bias corrected MLE)                              |   |   |   | 940.7  |   |

| A    | B | C | D                                                                                                                                        | E | F       | G | H | I | J                                                    | K | L      |
|------|---|---|------------------------------------------------------------------------------------------------------------------------------------------|---|---------|---|---|---|------------------------------------------------------|---|--------|
| 2212 |   |   | nu hat (MLE)                                                                                                                             |   | 187     |   |   |   | nu star (bias corrected)                             |   | 184.6  |
| 2213 |   |   | Adjusted Level of Significance ( $\beta$ )                                                                                               |   | 0.0484  |   |   |   |                                                      |   |        |
| 2214 |   |   | Approximate Chi Square Value (184.65, $\alpha$ )                                                                                         |   | 154.2   |   |   |   | Adjusted Chi Square Value (184.65, $\beta$ )         |   | 154    |
| 2215 |   |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                                        |   | 684.2   |   |   |   | 95% Gamma Adjusted UCL (use when $n < 50$ )          |   | 685.3  |
| 2216 |   |   | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |   |         |   |   |   |                                                      |   |        |
| 2217 |   |   | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |   |         |   |   |   |                                                      |   |        |
| 2218 |   |   | Mean (KM)                                                                                                                                |   | 571.5   |   |   |   | SD (KM)                                              |   | 1727   |
| 2219 |   |   | Variance (KM)                                                                                                                            |   | 2980872 |   |   |   | SE of Mean (KM)                                      |   | 140.5  |
| 2220 |   |   | k hat (KM)                                                                                                                               |   | 0.11    |   |   |   | k star (KM)                                          |   | 0.112  |
| 2221 |   |   | nu hat (KM)                                                                                                                              |   | 33.31   |   |   |   | nu star (KM)                                         |   | 33.98  |
| 2222 |   |   | theta hat (KM)                                                                                                                           |   | 5216    |   |   |   | theta star (KM)                                      |   | 5112   |
| 2223 |   |   | 80% gamma percentile (KM)                                                                                                                |   | 460.7   |   |   |   | 90% gamma percentile (KM)                            |   | 1585   |
| 2224 |   |   | 95% gamma percentile (KM)                                                                                                                |   | 3288    |   |   |   | 99% gamma percentile (KM)                            |   | 8580   |
| 2225 |   |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |   |         |   |   |   |                                                      |   |        |
| 2226 |   |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |   |         |   |   |   |                                                      |   |        |
| 2227 |   |   | Approximate Chi Square Value (33.98, $\alpha$ )                                                                                          |   | 21.65   |   |   |   | Adjusted Chi Square Value (33.98, $\beta$ )          |   | 21.56  |
| 2228 |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                      |   | 897     |   |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )       |   | 900.9  |
| 2229 |   |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |   |         |   |   |   |                                                      |   |        |
| 2230 |   |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |   |         |   |   |   |                                                      |   |        |
| 2231 |   |   | Shapiro Wilk Approximate Test Statistic                                                                                                  |   | 0.862   |   |   |   | <b>Shapiro Wilk GOF Test</b>                         |   |        |
| 2232 |   |   | 5% Shapiro Wilk P Value                                                                                                                  |   | 0       |   |   |   | Detected Data Not Lognormal at 5% Significance Level |   |        |
| 2233 |   |   | Lilliefors Test Statistic                                                                                                                |   | 0.202   |   |   |   | <b>Lilliefors GOF Test</b>                           |   |        |
| 2234 |   |   | 5% Lilliefors Critical Value                                                                                                             |   | 0.0725  |   |   |   | Detected Data Not Lognormal at 5% Significance Level |   |        |
| 2235 |   |   | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                                              |   |         |   |   |   |                                                      |   |        |
| 2236 |   |   | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                                              |   |         |   |   |   |                                                      |   |        |
| 2237 |   |   | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |   |         |   |   |   |                                                      |   |        |
| 2238 |   |   | Mean in Original Scale                                                                                                                   |   | 571.5   |   |   |   | Mean in Log Scale                                    |   | 5.393  |
| 2239 |   |   | SD in Original Scale                                                                                                                     |   | 1732    |   |   |   | SD in Log Scale                                      |   | 1.172  |
| 2240 |   |   | 95% t UCL (assumes normality of ROS data)                                                                                                |   | 804     |   |   |   | 95% Percentile Bootstrap UCL                         |   | 817.5  |
| 2241 |   |   | 95% BCA Bootstrap UCL                                                                                                                    |   | 881.1   |   |   |   | 95% Bootstrap t UCL                                  |   | 996.2  |
| 2242 |   |   | 95% H-UCL (Log ROS)                                                                                                                      |   | 547.8   |   |   |   |                                                      |   |        |
| 2243 |   |   | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |         |   |   |   |                                                      |   |        |
| 2244 |   |   | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |         |   |   |   |                                                      |   |        |
| 2245 |   |   | KM Mean (logged)                                                                                                                         |   | 5.393   |   |   |   | KM Geo Mean                                          |   | 219.8  |
| 2246 |   |   | KM SD (logged)                                                                                                                           |   | 1.169   |   |   |   | 95% Critical H Value (KM-Log)                        |   | 2.366  |
| 2247 |   |   | KM Standard Error of Mean (logged)                                                                                                       |   | 0.0952  |   |   |   | 95% H-UCL (KM -Log)                                  |   | 545.5  |
| 2248 |   |   | KM SD (logged)                                                                                                                           |   | 1.169   |   |   |   | 95% Critical H Value (KM-Log)                        |   | 2.366  |
| 2249 |   |   | KM Standard Error of Mean (logged)                                                                                                       |   | 0.0952  |   |   |   |                                                      |   |        |
| 2250 |   |   | <b>DL/2 Statistics</b>                                                                                                                   |   |         |   |   |   |                                                      |   |        |
| 2251 |   |   | <b>DL/2 Statistics</b>                                                                                                                   |   |         |   |   |   |                                                      |   |        |
| 2252 |   |   | <b>DL/2 Normal</b>                                                                                                                       |   |         |   |   |   | <b>DL/2 Log-Transformed</b>                          |   |        |
| 2253 |   |   | Mean in Original Scale                                                                                                                   |   | 571.4   |   |   |   | Mean in Log Scale                                    |   | 5.388  |
| 2254 |   |   | SD in Original Scale                                                                                                                     |   | 1732    |   |   |   | SD in Log Scale                                      |   | 1.187  |
| 2255 |   |   | 95% t UCL (Assumes normality)                                                                                                            |   | 804     |   |   |   | 95% H-Stat UCL                                       |   | 557    |
| 2256 |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |         |   |   |   |                                                      |   |        |
| 2257 |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |         |   |   |   |                                                      |   |        |
| 2258 |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |         |   |   |   |                                                      |   |        |
| 2259 |   |   | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                            |   |         |   |   |   |                                                      |   |        |
| 2260 |   |   | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                            |   |         |   |   |   |                                                      |   |        |
| 2261 |   |   | <b>Suggested UCL to Use</b>                                                                                                              |   |         |   |   |   |                                                      |   |        |
| 2262 |   |   | 95% KM (Chebyshev) UCL                                                                                                                   |   | 1184    |   |   |   |                                                      |   |        |
| 2263 |   |   | <b>Suggested UCL to Use</b>                                                                                                              |   |         |   |   |   |                                                      |   |        |
| 2264 |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |         |   |   |   |                                                      |   |        |
| 2265 |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |         |   |   |   |                                                      |   |        |
| 2266 |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |         |   |   |   |                                                      |   |        |
| 2267 |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |         |   |   |   |                                                      |   |        |
| 2268 |   |   | <b>Result (eu8_aluminum)</b>                                                                                                             |   |         |   |   |   |                                                      |   |        |
| 2269 |   |   | <b>Result (eu8_aluminum)</b>                                                                                                             |   |         |   |   |   |                                                      |   |        |
| 2270 |   |   | <b>Result (eu8_aluminum)</b>                                                                                                             |   |         |   |   |   |                                                      |   |        |
| 2271 |   |   | <b>General Statistics</b>                                                                                                                |   |         |   |   |   |                                                      |   |        |
| 2272 |   |   | Total Number of Observations                                                                                                             |   | 149     |   |   |   | Number of Distinct Observations                      |   | 141    |
| 2273 |   |   | Number of Detects                                                                                                                        |   | 146     |   |   |   | Number of Non-Detects                                |   | 3      |
| 2274 |   |   | Number of Distinct Detects                                                                                                               |   | 139     |   |   |   | Number of Distinct Non-Detects                       |   | 2      |
| 2275 |   |   | Minimum Detect                                                                                                                           |   | 29      |   |   |   | Minimum Non-Detect                                   |   | 0.7    |
| 2276 |   |   | Maximum Detect                                                                                                                           |   | 9350    |   |   |   | Maximum Non-Detect                                   |   | 20     |
| 2277 |   |   | Variance Detects                                                                                                                         |   | 3499949 |   |   |   | Percent Non-Detects                                  |   | 2.013% |
| 2278 |   |   | Mean Detects                                                                                                                             |   | 1452    |   |   |   | SD Detects                                           |   | 1871   |

|      | A                                                                                                                         | B | C | D | E | F       | G                                                            | H | I | J | K | L     |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---------|--------------------------------------------------------------|---|---|---|---|-------|
| 2279 | Median Detects                                                                                                            |   |   |   |   | 775.5   | CV Detects                                                   |   |   |   |   | 1.289 |
| 2280 | Skewness Detects                                                                                                          |   |   |   |   | 2.228   | Kurtosis Detects                                             |   |   |   |   | 5.303 |
| 2281 | Mean of Logged Detects                                                                                                    |   |   |   |   | 6.486   | SD of Logged Detects                                         |   |   |   |   | 1.37  |
| 2282 |                                                                                                                           |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2283 | <b>Normal GOF Test on Detects Only</b>                                                                                    |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2284 | Shapiro Wilk Test Statistic                                                                                               |   |   |   |   | 0.717   | <b>Normal GOF Test on Detected Observations Only</b>         |   |   |   |   |       |
| 2285 | 5% Shapiro Wilk P Value                                                                                                   |   |   |   |   | 0       | Detected Data Not Normal at 5% Significance Level            |   |   |   |   |       |
| 2286 | Lilliefors Test Statistic                                                                                                 |   |   |   |   | 0.223   | <b>Lilliefors GOF Test</b>                                   |   |   |   |   |       |
| 2287 | 5% Lilliefors Critical Value                                                                                              |   |   |   |   | 0.0737  | Detected Data Not Normal at 5% Significance Level            |   |   |   |   |       |
| 2288 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                  |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2289 |                                                                                                                           |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2290 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2291 | KM Mean                                                                                                                   |   |   |   |   | 1423    | KM Standard Error of Mean                                    |   |   |   |   | 152.6 |
| 2292 | KM SD                                                                                                                     |   |   |   |   | 1857    | 95% KM (BCA) UCL                                             |   |   |   |   | 1682  |
| 2293 | 95% KM (t) UCL                                                                                                            |   |   |   |   | 1675    | 95% KM (Percentile Bootstrap) UCL                            |   |   |   |   | 1691  |
| 2294 | 95% KM (z) UCL                                                                                                            |   |   |   |   | 1674    | 95% KM Bootstrap t UCL                                       |   |   |   |   | 1702  |
| 2295 | 90% KM Chebyshev UCL                                                                                                      |   |   |   |   | 1880    | 95% KM Chebyshev UCL                                         |   |   |   |   | 2088  |
| 2296 | 97.5% KM Chebyshev UCL                                                                                                    |   |   |   |   | 2376    | 99% KM Chebyshev UCL                                         |   |   |   |   | 2941  |
| 2297 |                                                                                                                           |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2298 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2299 | A-D Test Statistic                                                                                                        |   |   |   |   | 1.587   | <b>Anderson-Darling GOF Test</b>                             |   |   |   |   |       |
| 2300 | 5% A-D Critical Value                                                                                                     |   |   |   |   | 0.795   | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |   |   |       |
| 2301 | K-S Test Statistic                                                                                                        |   |   |   |   | 0.0882  | <b>Kolmogorov-Smirnov GOF</b>                                |   |   |   |   |       |
| 2302 | 5% K-S Critical Value                                                                                                     |   |   |   |   | 0.0806  | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |   |   |       |
| 2303 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                       |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2304 |                                                                                                                           |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2305 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2306 | k hat (MLE)                                                                                                               |   |   |   |   | 0.753   | k star (bias corrected MLE)                                  |   |   |   |   | 0.742 |
| 2307 | Theta hat (MLE)                                                                                                           |   |   |   |   | 1927    | Theta star (bias corrected MLE)                              |   |   |   |   | 1955  |
| 2308 | nu hat (MLE)                                                                                                              |   |   |   |   | 220     | nu star (bias corrected)                                     |   |   |   |   | 216.8 |
| 2309 | Mean (detects)                                                                                                            |   |   |   |   | 1452    |                                                              |   |   |   |   |       |
| 2310 |                                                                                                                           |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2311 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2312 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2313 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2314 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2315 | This is especially true when the sample size is small.                                                                    |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2316 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2317 | Minimum                                                                                                                   |   |   |   |   | 0.01    | Mean                                                         |   |   |   |   | 1423  |
| 2318 | Maximum                                                                                                                   |   |   |   |   | 9350    | Median                                                       |   |   |   |   | 741   |
| 2319 | SD                                                                                                                        |   |   |   |   | 1863    | CV                                                           |   |   |   |   | 1.31  |
| 2320 | k hat (MLE)                                                                                                               |   |   |   |   | 0.617   | k star (bias corrected MLE)                                  |   |   |   |   | 0.609 |
| 2321 | Theta hat (MLE)                                                                                                           |   |   |   |   | 2305    | Theta star (bias corrected MLE)                              |   |   |   |   | 2335  |
| 2322 | nu hat (MLE)                                                                                                              |   |   |   |   | 183.9   | nu star (bias corrected)                                     |   |   |   |   | 181.5 |
| 2323 | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   |   |   | 0.0484  |                                                              |   |   |   |   |       |
| 2324 | Approximate Chi Square Value (181.53, $\alpha$ )                                                                          |   |   |   |   | 151.4   | Adjusted Chi Square Value (181.53, $\beta$ )                 |   |   |   |   | 151.1 |
| 2325 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   |   |   | 1706    | 95% Gamma Adjusted UCL (use when $n < 50$ )                  |   |   |   |   | 1709  |
| 2326 |                                                                                                                           |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2327 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2328 | Mean (KM)                                                                                                                 |   |   |   |   | 1423    | SD (KM)                                                      |   |   |   |   | 1857  |
| 2329 | Variance (KM)                                                                                                             |   |   |   |   | 3447533 | SE of Mean (KM)                                              |   |   |   |   | 152.6 |
| 2330 | k hat (KM)                                                                                                                |   |   |   |   | 0.587   | k star (KM)                                                  |   |   |   |   | 0.58  |
| 2331 | nu hat (KM)                                                                                                               |   |   |   |   | 174.9   | nu star (KM)                                                 |   |   |   |   | 172.7 |
| 2332 | theta hat (KM)                                                                                                            |   |   |   |   | 2423    | theta star (KM)                                              |   |   |   |   | 2454  |
| 2333 | 80% gamma percentile (KM)                                                                                                 |   |   |   |   | 2345    | 90% gamma percentile (KM)                                    |   |   |   |   | 3728  |
| 2334 | 95% gamma percentile (KM)                                                                                                 |   |   |   |   | 5183    | 99% gamma percentile (KM)                                    |   |   |   |   | 8711  |
| 2335 |                                                                                                                           |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2336 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2337 | Approximate Chi Square Value (172.74, $\alpha$ )                                                                          |   |   |   |   | 143.3   | Adjusted Chi Square Value (172.74, $\beta$ )                 |   |   |   |   | 143.1 |
| 2338 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   |   |   |   | 1714    | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )               |   |   |   |   | 1717  |
| 2339 |                                                                                                                           |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2340 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |   |   |         |                                                              |   |   |   |   |       |
| 2341 | Shapiro Wilk Approximate Test Statistic                                                                                   |   |   |   |   | 0.962   | <b>Shapiro Wilk GOF Test</b>                                 |   |   |   |   |       |
| 2342 | 5% Shapiro Wilk P Value                                                                                                   |   |   |   |   | 0.00532 | Detected Data Not Lognormal at 5% Significance Level         |   |   |   |   |       |
| 2343 | Lilliefors Test Statistic                                                                                                 |   |   |   |   | 0.0654  | <b>Lilliefors GOF Test</b>                                   |   |   |   |   |       |
| 2344 | 5% Lilliefors Critical Value                                                                                              |   |   |   |   | 0.0737  | Detected Data appear Lognormal at 5% Significance Level      |   |   |   |   |       |
| 2345 | <b>Detected Data appear Approximate Lognormal at 5% Significance Level</b>                                                |   |   |   |   |         |                                                              |   |   |   |   |       |

| A    | B                                                                                                                                        | C     | D | E                                                 | F      | G                           | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|-------|---|---------------------------------------------------|--------|-----------------------------|---|---|---|---|---|
| 2346 |                                                                                                                                          |       |   |                                                   |        |                             |   |   |   |   |   |
| 2347 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |       |   |                                                   |        |                             |   |   |   |   |   |
| 2348 | Mean in Original Scale                                                                                                                   | 1423  |   | Mean in Log Scale                                 | 6.416  |                             |   |   |   |   |   |
| 2349 | SD in Original Scale                                                                                                                     | 1863  |   | SD in Log Scale                                   | 1.442  |                             |   |   |   |   |   |
| 2350 | 95% t UCL (assumes normality of ROS data)                                                                                                | 1676  |   | 95% Percentile Bootstrap UCL                      | 1692   |                             |   |   |   |   |   |
| 2351 | 95% BCA Bootstrap UCL                                                                                                                    | 1731  |   | 95% Bootstrap t UCL                               | 1717   |                             |   |   |   |   |   |
| 2352 | 95% H-UCL (Log ROS)                                                                                                                      | 2368  |   |                                                   |        |                             |   |   |   |   |   |
| 2353 |                                                                                                                                          |       |   |                                                   |        |                             |   |   |   |   |   |
| 2354 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |       |   |                                                   |        |                             |   |   |   |   |   |
| 2355 | KM Mean (logged)                                                                                                                         | 6.349 |   | KM Geo Mean                                       | 571.7  |                             |   |   |   |   |   |
| 2356 | KM SD (logged)                                                                                                                           | 1.658 |   | 95% Critical H Value (KM-Log)                     | 2.889  |                             |   |   |   |   |   |
| 2357 | KM Standard Error of Mean (logged)                                                                                                       | 0.136 |   | 95% H-UCL (KM -Log)                               | 3351   |                             |   |   |   |   |   |
| 2358 | KM SD (logged)                                                                                                                           | 1.658 |   | 95% Critical H Value (KM-Log)                     | 2.889  |                             |   |   |   |   |   |
| 2359 | KM Standard Error of Mean (logged)                                                                                                       | 0.136 |   |                                                   |        |                             |   |   |   |   |   |
| 2360 |                                                                                                                                          |       |   |                                                   |        |                             |   |   |   |   |   |
| 2361 | <b>DL/2 Statistics</b>                                                                                                                   |       |   |                                                   |        |                             |   |   |   |   |   |
| 2362 | <b>DL/2 Normal</b>                                                                                                                       |       |   |                                                   |        | <b>DL/2 Log-Transformed</b> |   |   |   |   |   |
| 2363 | Mean in Original Scale                                                                                                                   | 1423  |   | Mean in Log Scale                                 | 6.38   |                             |   |   |   |   |   |
| 2364 | SD in Original Scale                                                                                                                     | 1863  |   | SD in Log Scale                                   | 1.564  |                             |   |   |   |   |   |
| 2365 | 95% t UCL (Assumes normality)                                                                                                            | 1675  |   | 95% H-Stat UCL                                    | 2866   |                             |   |   |   |   |   |
| 2366 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |       |   |                                                   |        |                             |   |   |   |   |   |
| 2367 |                                                                                                                                          |       |   |                                                   |        |                             |   |   |   |   |   |
| 2368 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |       |   |                                                   |        |                             |   |   |   |   |   |
| 2369 | <b>Detected Data appear Approximate Lognormal Distributed at 5% Significance Level</b>                                                   |       |   |                                                   |        |                             |   |   |   |   |   |
| 2370 |                                                                                                                                          |       |   |                                                   |        |                             |   |   |   |   |   |
| 2371 | <b>Suggested UCL to Use</b>                                                                                                              |       |   |                                                   |        |                             |   |   |   |   |   |
| 2372 | KM H-UCL                                                                                                                                 | 3351  |   |                                                   |        |                             |   |   |   |   |   |
| 2373 |                                                                                                                                          |       |   |                                                   |        |                             |   |   |   |   |   |
| 2374 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |       |   |                                                   |        |                             |   |   |   |   |   |
| 2375 | Recommendations are based upon data size, data distribution, and skewness.                                                               |       |   |                                                   |        |                             |   |   |   |   |   |
| 2376 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |       |   |                                                   |        |                             |   |   |   |   |   |
| 2377 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |       |   |                                                   |        |                             |   |   |   |   |   |
| 2378 |                                                                                                                                          |       |   |                                                   |        |                             |   |   |   |   |   |
| 2379 | <b>Result (eu8_antimony)</b>                                                                                                             |       |   |                                                   |        |                             |   |   |   |   |   |
| 2380 |                                                                                                                                          |       |   |                                                   |        |                             |   |   |   |   |   |
| 2381 | <b>General Statistics</b>                                                                                                                |       |   |                                                   |        |                             |   |   |   |   |   |
| 2382 | Total Number of Observations                                                                                                             | 132   |   | Number of Distinct Observations                   | 3      |                             |   |   |   |   |   |
| 2383 | Number of Detects                                                                                                                        | 0     |   | Number of Non-Detects                             | 132    |                             |   |   |   |   |   |
| 2384 | Number of Distinct Detects                                                                                                               | 0     |   | Number of Distinct Non-Detects                    | 3      |                             |   |   |   |   |   |
| 2385 |                                                                                                                                          |       |   |                                                   |        |                             |   |   |   |   |   |
| 2386 | <b>Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!</b>                       |       |   |                                                   |        |                             |   |   |   |   |   |
| 2387 | <b>Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!</b>                 |       |   |                                                   |        |                             |   |   |   |   |   |
| 2388 | <b>The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).</b>        |       |   |                                                   |        |                             |   |   |   |   |   |
| 2389 |                                                                                                                                          |       |   |                                                   |        |                             |   |   |   |   |   |
| 2390 | <b>The data set for variable Result (eu8_antimony) was not processed!</b>                                                                |       |   |                                                   |        |                             |   |   |   |   |   |
| 2391 |                                                                                                                                          |       |   |                                                   |        |                             |   |   |   |   |   |
| 2392 |                                                                                                                                          |       |   |                                                   |        |                             |   |   |   |   |   |
| 2393 | <b>Result (eu8_arsenic)</b>                                                                                                              |       |   |                                                   |        |                             |   |   |   |   |   |
| 2394 |                                                                                                                                          |       |   |                                                   |        |                             |   |   |   |   |   |
| 2395 | <b>General Statistics</b>                                                                                                                |       |   |                                                   |        |                             |   |   |   |   |   |
| 2396 | Total Number of Observations                                                                                                             | 149   |   | Number of Distinct Observations                   | 43     |                             |   |   |   |   |   |
| 2397 | Number of Detects                                                                                                                        | 44    |   | Number of Non-Detects                             | 105    |                             |   |   |   |   |   |
| 2398 | Number of Distinct Detects                                                                                                               | 41    |   | Number of Distinct Non-Detects                    | 2      |                             |   |   |   |   |   |
| 2399 | Minimum Detect                                                                                                                           | 0.15  |   | Minimum Non-Detect                                | 0.026  |                             |   |   |   |   |   |
| 2400 | Maximum Detect                                                                                                                           | 24.6  |   | Maximum Non-Detect                                | 2.5    |                             |   |   |   |   |   |
| 2401 | Variance Detects                                                                                                                         | 32.72 |   | Percent Non-Detects                               | 70.47% |                             |   |   |   |   |   |
| 2402 | Mean Detects                                                                                                                             | 4.643 |   | SD Detects                                        | 5.72   |                             |   |   |   |   |   |
| 2403 | Median Detects                                                                                                                           | 3.19  |   | CV Detects                                        | 1.232  |                             |   |   |   |   |   |
| 2404 | Skewness Detects                                                                                                                         | 2.148 |   | Kurtosis Detects                                  | 4.65   |                             |   |   |   |   |   |
| 2405 | Mean of Logged Detects                                                                                                                   | 0.793 |   | SD of Logged Detects                              | 1.36   |                             |   |   |   |   |   |
| 2406 |                                                                                                                                          |       |   |                                                   |        |                             |   |   |   |   |   |
| 2407 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |       |   |                                                   |        |                             |   |   |   |   |   |
| 2408 | Shapiro Wilk Test Statistic                                                                                                              | 0.727 |   | <b>Shapiro Wilk GOF Test</b>                      |        |                             |   |   |   |   |   |
| 2409 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.944 |   | Detected Data Not Normal at 5% Significance Level |        |                             |   |   |   |   |   |
| 2410 | Lilliefors Test Statistic                                                                                                                | 0.233 |   | <b>Lilliefors GOF Test</b>                        |        |                             |   |   |   |   |   |
| 2411 | 5% Lilliefors Critical Value                                                                                                             | 0.132 |   | Detected Data Not Normal at 5% Significance Level |        |                             |   |   |   |   |   |
| 2412 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |       |   |                                                   |        |                             |   |   |   |   |   |

|      | A                                                                                                                         | B                                                   | C      | D | E | F | G | H | I | J                                                               | K      | L |
|------|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|--------|---|---|---|---|---|---|-----------------------------------------------------------------|--------|---|
| 2413 |                                                                                                                           |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2414 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2415 |                                                                                                                           | KM Mean                                             | 1.771  |   |   |   |   |   |   | KM Standard Error of Mean                                       | 0.308  |   |
| 2416 |                                                                                                                           | KM SD                                               | 3.61   |   |   |   |   |   |   | 95% KM (BCA) UCL                                                | 2.285  |   |
| 2417 |                                                                                                                           | 95% KM (t) UCL                                      | 2.281  |   |   |   |   |   |   | 95% KM (Percentile Bootstrap) UCL                               | 2.325  |   |
| 2418 |                                                                                                                           | 95% KM (z) UCL                                      | 2.277  |   |   |   |   |   |   | 95% KM Bootstrap t UCL                                          | 2.427  |   |
| 2419 |                                                                                                                           | 90% KM Chebyshev UCL                                | 2.694  |   |   |   |   |   |   | 95% KM Chebyshev UCL                                            | 3.112  |   |
| 2420 |                                                                                                                           | 97.5% KM Chebyshev UCL                              | 3.692  |   |   |   |   |   |   | 99% KM Chebyshev UCL                                            | 4.832  |   |
| 2421 |                                                                                                                           |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2422 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2423 |                                                                                                                           | A-D Test Statistic                                  | 0.586  |   |   |   |   |   |   | <b>Anderson-Darling GOF Test</b>                                |        |   |
| 2424 |                                                                                                                           | 5% A-D Critical Value                               | 0.787  |   |   |   |   |   |   | Detected data appear Gamma Distributed at 5% Significance Level |        |   |
| 2425 |                                                                                                                           | K-S Test Statistic                                  | 0.108  |   |   |   |   |   |   | <b>Kolmogorov-Smimov GOF</b>                                    |        |   |
| 2426 |                                                                                                                           | 5% K-S Critical Value                               | 0.138  |   |   |   |   |   |   | Detected data appear Gamma Distributed at 5% Significance Level |        |   |
| 2427 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                    |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2428 |                                                                                                                           |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2429 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2430 |                                                                                                                           | k hat (MLE)                                         | 0.8    |   |   |   |   |   |   | k star (bias corrected MLE)                                     | 0.76   |   |
| 2431 |                                                                                                                           | Theta hat (MLE)                                     | 5.806  |   |   |   |   |   |   | Theta star (bias corrected MLE)                                 | 6.107  |   |
| 2432 |                                                                                                                           | nu hat (MLE)                                        | 70.37  |   |   |   |   |   |   | nu star (bias corrected)                                        | 66.91  |   |
| 2433 |                                                                                                                           | Mean (detects)                                      | 4.643  |   |   |   |   |   |   |                                                                 |        |   |
| 2434 |                                                                                                                           |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2435 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2436 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2437 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2438 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2439 | This is especially true when the sample size is small.                                                                    |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2440 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2441 |                                                                                                                           | Minimum                                             | 0.01   |   |   |   |   |   |   | Mean                                                            | 1.726  |   |
| 2442 |                                                                                                                           | Maximum                                             | 24.6   |   |   |   |   |   |   | Median                                                          | 0.148  |   |
| 2443 |                                                                                                                           | SD                                                  | 3.707  |   |   |   |   |   |   | CV                                                              | 2.147  |   |
| 2444 |                                                                                                                           | k hat (MLE)                                         | 0.276  |   |   |   |   |   |   | k star (bias corrected MLE)                                     | 0.275  |   |
| 2445 |                                                                                                                           | Theta hat (MLE)                                     | 6.261  |   |   |   |   |   |   | Theta star (bias corrected MLE)                                 | 6.285  |   |
| 2446 |                                                                                                                           | nu hat (MLE)                                        | 82.18  |   |   |   |   |   |   | nu star (bias corrected)                                        | 81.85  |   |
| 2447 |                                                                                                                           | Adjusted Level of Significance ( $\beta$ )          | 0.0484 |   |   |   |   |   |   |                                                                 |        |   |
| 2448 |                                                                                                                           | Approximate Chi Square Value (81.85, $\alpha$ )     | 62.01  |   |   |   |   |   |   | Adjusted Chi Square Value (81.85, $\beta$ )                     | 61.84  |   |
| 2449 |                                                                                                                           | 95% Gamma Approximate UCL (use when $n \geq 50$ )   | 2.279  |   |   |   |   |   |   | 95% Gamma Adjusted UCL (use when $n < 50$ )                     | 2.285  |   |
| 2450 |                                                                                                                           |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2451 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2452 |                                                                                                                           | Mean (KM)                                           | 1.771  |   |   |   |   |   |   | SD (KM)                                                         | 3.61   |   |
| 2453 |                                                                                                                           | Variance (KM)                                       | 13.03  |   |   |   |   |   |   | SE of Mean (KM)                                                 | 0.308  |   |
| 2454 |                                                                                                                           | k hat (KM)                                          | 0.241  |   |   |   |   |   |   | k star (KM)                                                     | 0.24   |   |
| 2455 |                                                                                                                           | nu hat (KM)                                         | 71.74  |   |   |   |   |   |   | nu star (KM)                                                    | 71.63  |   |
| 2456 |                                                                                                                           | theta hat (KM)                                      | 7.358  |   |   |   |   |   |   | theta star (KM)                                                 | 7.37   |   |
| 2457 |                                                                                                                           | 80% gamma percentile (KM)                           | 2.536  |   |   |   |   |   |   | 90% gamma percentile (KM)                                       | 5.33   |   |
| 2458 |                                                                                                                           | 95% gamma percentile (KM)                           | 8.674  |   |   |   |   |   |   | 99% gamma percentile (KM)                                       | 17.62  |   |
| 2459 |                                                                                                                           |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2460 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2461 |                                                                                                                           | Approximate Chi Square Value (71.63, $\alpha$ )     | 53.14  |   |   |   |   |   |   | Adjusted Chi Square Value (71.63, $\beta$ )                     | 52.98  |   |
| 2462 |                                                                                                                           | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ ) | 2.388  |   |   |   |   |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )                  | 2.395  |   |
| 2463 |                                                                                                                           |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2464 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2465 |                                                                                                                           | Shapiro Wilk Test Statistic                         | 0.949  |   |   |   |   |   |   | <b>Shapiro Wilk GOF Test</b>                                    |        |   |
| 2466 |                                                                                                                           | 5% Shapiro Wilk Critical Value                      | 0.944  |   |   |   |   |   |   | Detected Data appear Lognormal at 5% Significance Level         |        |   |
| 2467 |                                                                                                                           | Lilliefors Test Statistic                           | 0.157  |   |   |   |   |   |   | <b>Lilliefors GOF Test</b>                                      |        |   |
| 2468 |                                                                                                                           | 5% Lilliefors Critical Value                        | 0.132  |   |   |   |   |   |   | Detected Data Not Lognormal at 5% Significance Level            |        |   |
| 2469 | <b>Detected Data appear Approximate Lognormal at 5% Significance Level</b>                                                |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2470 |                                                                                                                           |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2471 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2472 |                                                                                                                           | Mean in Original Scale                              | 1.834  |   |   |   |   |   |   | Mean in Log Scale                                               | -0.452 |   |
| 2473 |                                                                                                                           | SD in Original Scale                                | 3.621  |   |   |   |   |   |   | SD in Log Scale                                                 | 1.475  |   |
| 2474 |                                                                                                                           | 95% t UCL (assumes normality of ROS data)           | 2.325  |   |   |   |   |   |   | 95% Percentile Bootstrap UCL                                    | 2.372  |   |
| 2475 |                                                                                                                           | 95% BCA Bootstrap UCL                               | 2.443  |   |   |   |   |   |   | 95% Bootstrap t UCL                                             | 2.516  |   |
| 2476 |                                                                                                                           | 95% H-UCL (Log ROS)                                 | 2.614  |   |   |   |   |   |   |                                                                 |        |   |
| 2477 |                                                                                                                           |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2478 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |                                                     |        |   |   |   |   |   |   |                                                                 |        |   |
| 2479 |                                                                                                                           | KM Mean (logged)                                    | -0.554 |   |   |   |   |   |   | KM Geo Mean                                                     | 0.575  |   |

| A    | B | C | D | E                                                                                                                                        | F      | G | H | I                           | J | K                                                            | L      |
|------|---|---|---|------------------------------------------------------------------------------------------------------------------------------------------|--------|---|---|-----------------------------|---|--------------------------------------------------------------|--------|
| 2480 |   |   |   | KM SD (logged)                                                                                                                           | 1.58   |   |   |                             |   | 95% Critical H Value (KM-Log)                                | 2.8    |
| 2481 |   |   |   | KM Standard Error of Mean (logged)                                                                                                       | 0.245  |   |   |                             |   | 95% H-UCL (KM -Log)                                          | 2.881  |
| 2482 |   |   |   | KM SD (logged)                                                                                                                           | 1.58   |   |   |                             |   | 95% Critical H Value (KM-Log)                                | 2.8    |
| 2483 |   |   |   | KM Standard Error of Mean (logged)                                                                                                       | 0.245  |   |   |                             |   |                                                              |        |
| 2484 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                              |        |
| 2485 |   |   |   | <b>DL/2 Statistics</b>                                                                                                                   |        |   |   |                             |   |                                                              |        |
| 2486 |   |   |   | <b>DL/2 Normal</b>                                                                                                                       |        |   |   | <b>DL/2 Log-Transformed</b> |   |                                                              |        |
| 2487 |   |   |   | Mean in Original Scale                                                                                                                   | 2.227  |   |   |                             |   | Mean in Log Scale                                            | 0.3    |
| 2488 |   |   |   | SD in Original Scale                                                                                                                     | 3.464  |   |   |                             |   | SD in Log Scale                                              | 1.025  |
| 2489 |   |   |   | 95% t UCL (Assumes normality)                                                                                                            | 2.697  |   |   |                             |   | 95% H-Stat UCL                                               | 2.752  |
| 2490 |   |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |        |   |   |                             |   |                                                              |        |
| 2491 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                              |        |
| 2492 |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |   |   |                             |   |                                                              |        |
| 2493 |   |   |   | <b>Detected Data appear Gamma Distributed at 5% Significance Level</b>                                                                   |        |   |   |                             |   |                                                              |        |
| 2494 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                              |        |
| 2495 |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |        |   |   |                             |   |                                                              |        |
| 2496 |   |   |   | 95% KM Approximate Gamma UCL                                                                                                             | 2.388  |   |   |                             |   |                                                              |        |
| 2497 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                              |        |
| 2498 |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |   |   |                             |   |                                                              |        |
| 2499 |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |   |   |                             |   |                                                              |        |
| 2500 |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |   |   |                             |   |                                                              |        |
| 2501 |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |   |   |                             |   |                                                              |        |
| 2502 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                              |        |
| 2503 |   |   |   | <b>Result (eu8_beryllium)</b>                                                                                                            |        |   |   |                             |   |                                                              |        |
| 2504 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                              |        |
| 2505 |   |   |   | <b>General Statistics</b>                                                                                                                |        |   |   |                             |   |                                                              |        |
| 2506 |   |   |   | Total Number of Observations                                                                                                             | 149    |   |   |                             |   | Number of Distinct Observations                              | 12     |
| 2507 |   |   |   | Number of Detects                                                                                                                        | 12     |   |   |                             |   | Number of Non-Detects                                        | 137    |
| 2508 |   |   |   | Number of Distinct Detects                                                                                                               | 10     |   |   |                             |   | Number of Distinct Non-Detects                               | 2      |
| 2509 |   |   |   | Minimum Detect                                                                                                                           | 0.06   |   |   |                             |   | Minimum Non-Detect                                           | 0.043  |
| 2510 |   |   |   | Maximum Detect                                                                                                                           | 0.35   |   |   |                             |   | Maximum Non-Detect                                           | 2      |
| 2511 |   |   |   | Variance Detects                                                                                                                         | 0.0145 |   |   |                             |   | Percent Non-Detects                                          | 91.95% |
| 2512 |   |   |   | Mean Detects                                                                                                                             | 0.198  |   |   |                             |   | SD Detects                                                   | 0.12   |
| 2513 |   |   |   | Median Detects                                                                                                                           | 0.22   |   |   |                             |   | CV Detects                                                   | 0.607  |
| 2514 |   |   |   | Skewness Detects                                                                                                                         | -0.039 |   |   |                             |   | Kurtosis Detects                                             | -2.069 |
| 2515 |   |   |   | Mean of Logged Detects                                                                                                                   | -1.84  |   |   |                             |   | SD of Logged Detects                                         | 0.74   |
| 2516 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                              |        |
| 2517 |   |   |   | <b>Normal GOF Test on Detects Only</b>                                                                                                   |        |   |   |                             |   |                                                              |        |
| 2518 |   |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.83   |   |   |                             |   | <b>Shapiro Wilk GOF Test</b>                                 |        |
| 2519 |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                           | 0.859  |   |   |                             |   | Detected Data Not Normal at 5% Significance Level            |        |
| 2520 |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.233  |   |   |                             |   | <b>Lilliefors GOF Test</b>                                   |        |
| 2521 |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.243  |   |   |                             |   | Detected Data appear Normal at 5% Significance Level         |        |
| 2522 |   |   |   | <b>Detected Data appear Approximate Normal at 5% Significance Level</b>                                                                  |        |   |   |                             |   |                                                              |        |
| 2523 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                              |        |
| 2524 |   |   |   | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |        |   |   |                             |   |                                                              |        |
| 2525 |   |   |   | KM Mean                                                                                                                                  | 0.124  |   |   |                             |   | KM Standard Error of Mean                                    | 0.0248 |
| 2526 |   |   |   | KM SD                                                                                                                                    | 0.114  |   |   |                             |   | 95% KM (BCA) UCL                                             | 0.172  |
| 2527 |   |   |   | 95% KM (t) UCL                                                                                                                           | 0.165  |   |   |                             |   | 95% KM (Percentile Bootstrap) UCL                            | 0.164  |
| 2528 |   |   |   | 95% KM (z) UCL                                                                                                                           | 0.165  |   |   |                             |   | 95% KM Bootstrap t UCL                                       | 0.175  |
| 2529 |   |   |   | 90% KM Chebyshev UCL                                                                                                                     | 0.198  |   |   |                             |   | 95% KM Chebyshev UCL                                         | 0.232  |
| 2530 |   |   |   | 97.5% KM Chebyshev UCL                                                                                                                   | 0.279  |   |   |                             |   | 99% KM Chebyshev UCL                                         | 0.371  |
| 2531 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                              |        |
| 2532 |   |   |   | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |        |   |   |                             |   |                                                              |        |
| 2533 |   |   |   | A-D Test Statistic                                                                                                                       | 0.969  |   |   |                             |   | <b>Anderson-Darling GOF Test</b>                             |        |
| 2534 |   |   |   | 5% A-D Critical Value                                                                                                                    | 0.741  |   |   |                             |   | Detected Data Not Gamma Distributed at 5% Significance Level |        |
| 2535 |   |   |   | K-S Test Statistic                                                                                                                       | 0.263  |   |   |                             |   | <b>Kolmogorov-Smirnov GOF</b>                                |        |
| 2536 |   |   |   | 5% K-S Critical Value                                                                                                                    | 0.248  |   |   |                             |   | Detected Data Not Gamma Distributed at 5% Significance Level |        |
| 2537 |   |   |   | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                                      |        |   |   |                             |   |                                                              |        |
| 2538 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                              |        |
| 2539 |   |   |   | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |        |   |   |                             |   |                                                              |        |
| 2540 |   |   |   | k hat (MLE)                                                                                                                              | 2.405  |   |   |                             |   | k star (bias corrected MLE)                                  | 1.859  |
| 2541 |   |   |   | Theta hat (MLE)                                                                                                                          | 0.0825 |   |   |                             |   | Theta star (bias corrected MLE)                              | 0.107  |
| 2542 |   |   |   | nu hat (MLE)                                                                                                                             | 57.71  |   |   |                             |   | nu star (bias corrected)                                     | 44.62  |
| 2543 |   |   |   | Mean (detects)                                                                                                                           | 0.198  |   |   |                             |   |                                                              |        |
| 2544 |   |   |   |                                                                                                                                          |        |   |   |                             |   |                                                              |        |
| 2545 |   |   |   | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |        |   |   |                             |   |                                                              |        |
| 2546 |   |   |   | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |        |   |   |                             |   |                                                              |        |

| A    | B                                                                                                                            | C      | D                                                    | E                                              | F      | G                           | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------|--------|------------------------------------------------------|------------------------------------------------|--------|-----------------------------|---|---|---|---|---|
| 2547 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)    |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2548 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                 |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2549 | This is especially true when the sample size is small.                                                                       |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2550 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                  |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2551 | Minimum                                                                                                                      | 0.01   |                                                      | Mean                                           | 0.115  |                             |   |   |   |   |   |
| 2552 | Maximum                                                                                                                      | 0.631  |                                                      | Median                                         | 0.0619 |                             |   |   |   |   |   |
| 2553 | SD                                                                                                                           | 0.131  |                                                      | CV                                             | 1.137  |                             |   |   |   |   |   |
| 2554 | k hat (MLE)                                                                                                                  | 0.747  |                                                      | k star (bias corrected MLE)                    | 0.737  |                             |   |   |   |   |   |
| 2555 | Theta hat (MLE)                                                                                                              | 0.154  |                                                      | Theta star (bias corrected MLE)                | 0.156  |                             |   |   |   |   |   |
| 2556 | nu hat (MLE)                                                                                                                 | 222.7  |                                                      | nu star (bias corrected)                       | 219.6  |                             |   |   |   |   |   |
| 2557 | Adjusted Level of Significance ( $\beta$ )                                                                                   | 0.0484 |                                                      |                                                |        |                             |   |   |   |   |   |
| 2558 | Approximate Chi Square Value (219.56, $\alpha$ )                                                                             | 186.3  |                                                      | Adjusted Chi Square Value (219.56, $\beta$ )   | 186    |                             |   |   |   |   |   |
| 2559 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                            | 0.136  |                                                      | 95% Gamma Adjusted UCL (use when $n < 50$ )    | 0.136  |                             |   |   |   |   |   |
| 2560 |                                                                                                                              |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2561 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                      |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2562 | Mean (KM)                                                                                                                    | 0.124  |                                                      | SD (KM)                                        | 0.114  |                             |   |   |   |   |   |
| 2563 | Variance (KM)                                                                                                                | 0.0129 |                                                      | SE of Mean (KM)                                | 0.0248 |                             |   |   |   |   |   |
| 2564 | k hat (KM)                                                                                                                   | 1.189  |                                                      | k star (KM)                                    | 1.17   |                             |   |   |   |   |   |
| 2565 | nu hat (KM)                                                                                                                  | 354.3  |                                                      | nu star (KM)                                   | 348.5  |                             |   |   |   |   |   |
| 2566 | theta hat (KM)                                                                                                               | 0.104  |                                                      | theta star (KM)                                | 0.106  |                             |   |   |   |   |   |
| 2567 | 80% gamma percentile (KM)                                                                                                    | 0.197  |                                                      | 90% gamma percentile (KM)                      | 0.275  |                             |   |   |   |   |   |
| 2568 | 95% gamma percentile (KM)                                                                                                    | 0.352  |                                                      | 99% gamma percentile (KM)                      | 0.528  |                             |   |   |   |   |   |
| 2569 |                                                                                                                              |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2570 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                    |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2571 | Approximate Chi Square Value (348.52, $\alpha$ )                                                                             | 306.3  |                                                      | Adjusted Chi Square Value (348.52, $\beta$ )   | 305.9  |                             |   |   |   |   |   |
| 2572 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                          | 0.141  |                                                      | 95% Gamma Adjusted KM-UCL (use when $n < 50$ ) | 0.141  |                             |   |   |   |   |   |
| 2573 |                                                                                                                              |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2574 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                      |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2575 | Shapiro Wilk Test Statistic                                                                                                  | 0.818  |                                                      | <b>Shapiro Wilk GOF Test</b>                   |        |                             |   |   |   |   |   |
| 2576 | 5% Shapiro Wilk Critical Value                                                                                               | 0.859  | Detected Data Not Lognormal at 5% Significance Level |                                                |        |                             |   |   |   |   |   |
| 2577 | Lilliefors Test Statistic                                                                                                    | 0.263  |                                                      | <b>Lilliefors GOF Test</b>                     |        |                             |   |   |   |   |   |
| 2578 | 5% Lilliefors Critical Value                                                                                                 | 0.243  | Detected Data Not Lognormal at 5% Significance Level |                                                |        |                             |   |   |   |   |   |
| 2579 | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                                  |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2580 |                                                                                                                              |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2581 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                    |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2582 | Mean in Original Scale                                                                                                       | 0.128  |                                                      | Mean in Log Scale                              | -2.759 |                             |   |   |   |   |   |
| 2583 | SD in Original Scale                                                                                                         | 0.183  |                                                      | SD in Log Scale                                | 1.22   |                             |   |   |   |   |   |
| 2584 | 95% t UCL (assumes normality of ROS data)                                                                                    | 0.153  |                                                      | 95% Percentile Bootstrap UCL                   | 0.154  |                             |   |   |   |   |   |
| 2585 | 95% BCA Bootstrap UCL                                                                                                        | 0.157  |                                                      | 95% Bootstrap t UCL                            | 0.158  |                             |   |   |   |   |   |
| 2586 | 95% H-UCL (Log ROS)                                                                                                          | 0.17   |                                                      |                                                |        |                             |   |   |   |   |   |
| 2587 |                                                                                                                              |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2588 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                      |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2589 | KM Mean (logged)                                                                                                             | -2.465 |                                                      | KM Geo Mean                                    | 0.085  |                             |   |   |   |   |   |
| 2590 | KM SD (logged)                                                                                                               | 0.829  |                                                      | 95% Critical H Value (KM-Log)                  | 2.057  |                             |   |   |   |   |   |
| 2591 | KM Standard Error of Mean (logged)                                                                                           | 0.181  |                                                      | 95% H-UCL (KM -Log)                            | 0.138  |                             |   |   |   |   |   |
| 2592 | KM SD (logged)                                                                                                               | 0.829  |                                                      | 95% Critical H Value (KM-Log)                  | 2.057  |                             |   |   |   |   |   |
| 2593 | KM Standard Error of Mean (logged)                                                                                           | 0.181  |                                                      |                                                |        |                             |   |   |   |   |   |
| 2594 |                                                                                                                              |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2595 | <b>DL/2 Statistics</b>                                                                                                       |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2596 | <b>DL/2 Normal</b>                                                                                                           |        |                                                      |                                                |        | <b>DL/2 Log-Transformed</b> |   |   |   |   |   |
| 2597 | Mean in Original Scale                                                                                                       | 0.863  |                                                      | Mean in Log Scale                              | -0.432 |                             |   |   |   |   |   |
| 2598 | SD in Original Scale                                                                                                         | 0.325  |                                                      | SD in Log Scale                                | 1.106  |                             |   |   |   |   |   |
| 2599 | 95% t UCL (Assumes normality)                                                                                                | 0.907  |                                                      | 95% H-Stat UCL                                 | 1.476  |                             |   |   |   |   |   |
| 2600 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                     |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2601 |                                                                                                                              |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2602 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                        |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2603 | <b>Detected Data appear Approximate Normal Distributed at 5% Significance Level</b>                                          |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2604 |                                                                                                                              |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2605 | <b>Suggested UCL to Use</b>                                                                                                  |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2606 | 95% KM (t) UCL                                                                                                               | 0.165  |                                                      |                                                |        |                             |   |   |   |   |   |
| 2607 |                                                                                                                              |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2608 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                               |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2609 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL       |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2610 |                                                                                                                              |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2611 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2612 | Recommendations are based upon data size, data distribution, and skewness.                                                   |        |                                                      |                                                |        |                             |   |   |   |   |   |
| 2613 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).     |        |                                                      |                                                |        |                             |   |   |   |   |   |

| A    | B                                                                                                                                        | C      | D                                                            | E      | F | G | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------------------------------------------------------|--------|---|---|---|---|---|---|---|
| 2614 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |                                                              |        |   |   |   |   |   |   |   |
| 2615 |                                                                                                                                          |        |                                                              |        |   |   |   |   |   |   |   |
| 2616 | <b>Result (eu8_cadmium)</b>                                                                                                              |        |                                                              |        |   |   |   |   |   |   |   |
| 2617 |                                                                                                                                          |        |                                                              |        |   |   |   |   |   |   |   |
| 2618 | <b>General Statistics</b>                                                                                                                |        |                                                              |        |   |   |   |   |   |   |   |
| 2619 | Total Number of Observations                                                                                                             | 149    | Number of Distinct Observations                              | 89     |   |   |   |   |   |   |   |
| 2620 | Number of Detects                                                                                                                        | 95     | Number of Non-Detects                                        | 54     |   |   |   |   |   |   |   |
| 2621 | Number of Distinct Detects                                                                                                               | 89     | Number of Distinct Non-Detects                               | 1      |   |   |   |   |   |   |   |
| 2622 | Minimum Detect                                                                                                                           | 0.13   | Minimum Non-Detect                                           | 0.5    |   |   |   |   |   |   |   |
| 2623 | Maximum Detect                                                                                                                           | 16.4   | Maximum Non-Detect                                           | 0.5    |   |   |   |   |   |   |   |
| 2624 | Variance Detects                                                                                                                         | 8.077  | Percent Non-Detects                                          | 36.24% |   |   |   |   |   |   |   |
| 2625 | Mean Detects                                                                                                                             | 1.869  | SD Detects                                                   | 2.842  |   |   |   |   |   |   |   |
| 2626 | Median Detects                                                                                                                           | 0.899  | CV Detects                                                   | 1.521  |   |   |   |   |   |   |   |
| 2627 | Skewness Detects                                                                                                                         | 3.061  | Kurtosis Detects                                             | 9.5    |   |   |   |   |   |   |   |
| 2628 | Mean of Logged Detects                                                                                                                   | 0.105  | SD of Logged Detects                                         | 0.852  |   |   |   |   |   |   |   |
| 2629 |                                                                                                                                          |        |                                                              |        |   |   |   |   |   |   |   |
| 2630 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |        |                                                              |        |   |   |   |   |   |   |   |
| 2631 | Shapiro Wilk Test Statistic                                                                                                              | 0.508  | <b>Normal GOF Test on Detected Observations Only</b>         |        |   |   |   |   |   |   |   |
| 2632 | 5% Shapiro Wilk P Value                                                                                                                  | 0      | Detected Data Not Normal at 5% Significance Level            |        |   |   |   |   |   |   |   |
| 2633 | Lilliefors Test Statistic                                                                                                                | 0.383  | <b>Lilliefors GOF Test</b>                                   |        |   |   |   |   |   |   |   |
| 2634 | 5% Lilliefors Critical Value                                                                                                             | 0.0911 | Detected Data Not Normal at 5% Significance Level            |        |   |   |   |   |   |   |   |
| 2635 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |        |                                                              |        |   |   |   |   |   |   |   |
| 2636 |                                                                                                                                          |        |                                                              |        |   |   |   |   |   |   |   |
| 2637 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |        |                                                              |        |   |   |   |   |   |   |   |
| 2638 | KM Mean                                                                                                                                  | 1.238  | KM Standard Error of Mean                                    | 0.198  |   |   |   |   |   |   |   |
| 2639 | KM SD                                                                                                                                    | 2.407  | 95% KM (BCA) UCL                                             | 1.761  |   |   |   |   |   |   |   |
| 2640 | 95% KM (t) UCL                                                                                                                           | 1.567  | 95% KM (Percentile Bootstrap) UCL                            | 1.638  |   |   |   |   |   |   |   |
| 2641 | 95% KM (z) UCL                                                                                                                           | 1.565  | 95% KM Bootstrap t UCL                                       | 1.615  |   |   |   |   |   |   |   |
| 2642 | 90% KM Chebyshev UCL                                                                                                                     | 1.833  | 95% KM Chebyshev UCL                                         | 2.103  |   |   |   |   |   |   |   |
| 2643 | 97.5% KM Chebyshev UCL                                                                                                                   | 2.476  | 99% KM Chebyshev UCL                                         | 3.211  |   |   |   |   |   |   |   |
| 2644 |                                                                                                                                          |        |                                                              |        |   |   |   |   |   |   |   |
| 2645 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |        |                                                              |        |   |   |   |   |   |   |   |
| 2646 | A-D Test Statistic                                                                                                                       | 12.2   | <b>Anderson-Darling GOF Test</b>                             |        |   |   |   |   |   |   |   |
| 2647 | 5% A-D Critical Value                                                                                                                    | 0.78   | Detected Data Not Gamma Distributed at 5% Significance Level |        |   |   |   |   |   |   |   |
| 2648 | K-S Test Statistic                                                                                                                       | 0.29   | <b>Kolmogorov-Smimov GOF</b>                                 |        |   |   |   |   |   |   |   |
| 2649 | 5% K-S Critical Value                                                                                                                    | 0.0944 | Detected Data Not Gamma Distributed at 5% Significance Level |        |   |   |   |   |   |   |   |
| 2650 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                                      |        |                                                              |        |   |   |   |   |   |   |   |
| 2651 |                                                                                                                                          |        |                                                              |        |   |   |   |   |   |   |   |
| 2652 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |        |                                                              |        |   |   |   |   |   |   |   |
| 2653 | k hat (MLE)                                                                                                                              | 1.098  | k star (bias corrected MLE)                                  | 1.07   |   |   |   |   |   |   |   |
| 2654 | Theta hat (MLE)                                                                                                                          | 1.702  | Theta star (bias corrected MLE)                              | 1.746  |   |   |   |   |   |   |   |
| 2655 | nu hat (MLE)                                                                                                                             | 208.6  | nu star (bias corrected)                                     | 203.4  |   |   |   |   |   |   |   |
| 2656 | Mean (detects)                                                                                                                           | 1.869  |                                                              |        |   |   |   |   |   |   |   |
| 2657 |                                                                                                                                          |        |                                                              |        |   |   |   |   |   |   |   |
| 2658 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |        |                                                              |        |   |   |   |   |   |   |   |
| 2659 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |        |                                                              |        |   |   |   |   |   |   |   |
| 2660 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |        |                                                              |        |   |   |   |   |   |   |   |
| 2661 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |        |                                                              |        |   |   |   |   |   |   |   |
| 2662 | This is especially true when the sample size is small.                                                                                   |        |                                                              |        |   |   |   |   |   |   |   |
| 2663 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |        |                                                              |        |   |   |   |   |   |   |   |
| 2664 | Minimum                                                                                                                                  | 0.01   | Mean                                                         | 1.195  |   |   |   |   |   |   |   |
| 2665 | Maximum                                                                                                                                  | 16.4   | Median                                                       | 0.662  |   |   |   |   |   |   |   |
| 2666 | SD                                                                                                                                       | 2.436  | CV                                                           | 2.038  |   |   |   |   |   |   |   |
| 2667 | k hat (MLE)                                                                                                                              | 0.374  | k star (bias corrected MLE)                                  | 0.371  |   |   |   |   |   |   |   |
| 2668 | Theta hat (MLE)                                                                                                                          | 3.197  | Theta star (bias corrected MLE)                              | 3.224  |   |   |   |   |   |   |   |
| 2669 | nu hat (MLE)                                                                                                                             | 111.4  | nu star (bias corrected)                                     | 110.5  |   |   |   |   |   |   |   |
| 2670 | Adjusted Level of Significance ( $\beta$ )                                                                                               | 0.0484 |                                                              |        |   |   |   |   |   |   |   |
| 2671 | Approximate Chi Square Value (110.46, $\alpha$ )                                                                                         | 87.2   | Adjusted Chi Square Value (110.46, $\beta$ )                 | 87     |   |   |   |   |   |   |   |
| 2672 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                                        | 1.514  | 95% Gamma Adjusted UCL (use when $n < 50$ )                  | 1.517  |   |   |   |   |   |   |   |
| 2673 |                                                                                                                                          |        |                                                              |        |   |   |   |   |   |   |   |
| 2674 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |        |                                                              |        |   |   |   |   |   |   |   |
| 2675 | Mean (KM)                                                                                                                                | 1.238  | SD (KM)                                                      | 2.407  |   |   |   |   |   |   |   |
| 2676 | Variance (KM)                                                                                                                            | 5.794  | SE of Mean (KM)                                              | 0.198  |   |   |   |   |   |   |   |
| 2677 | k hat (KM)                                                                                                                               | 0.265  | k star (KM)                                                  | 0.264  |   |   |   |   |   |   |   |
| 2678 | nu hat (KM)                                                                                                                              | 78.89  | nu star (KM)                                                 | 78.63  |   |   |   |   |   |   |   |
| 2679 | theta hat (KM)                                                                                                                           | 4.678  | theta star (KM)                                              | 4.694  |   |   |   |   |   |   |   |
| 2680 | 80% gamma percentile (KM)                                                                                                                | 1.832  | 90% gamma percentile (KM)                                    | 3.702  |   |   |   |   |   |   |   |

|      | A                                                                                                                                        | B | C | D      | E                                                    | F                                                    | G                           | H      | I | J     | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|------------------------------------------------------|------------------------------------------------------|-----------------------------|--------|---|-------|---|---|
| 2681 | 95% gamma percentile (KM)                                                                                                                |   |   |        | 5.898                                                | 99% gamma percentile (KM)                            |                             |        |   | 11.7  |   |   |
| 2682 |                                                                                                                                          |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2683 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2684 | Approximate Chi Square Value (78.63, $\alpha$ )                                                                                          |   |   |        | 59.2                                                 | Adjusted Chi Square Value (78.63, $\beta$ )          |                             |        |   | 59.04 |   |   |
| 2685 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                      |   |   |        | 1.645                                                | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )       |                             |        |   | 1.649 |   |   |
| 2686 |                                                                                                                                          |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2687 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2688 | Shapiro Wilk Approximate Test Statistic                                                                                                  |   |   |        | 0.809                                                | <b>Shapiro Wilk GOF Test</b>                         |                             |        |   |       |   |   |
| 2689 | 5% Shapiro Wilk P Value                                                                                                                  |   |   |        | 0                                                    | Detected Data Not Lognormal at 5% Significance Level |                             |        |   |       |   |   |
| 2690 | Lilliefors Test Statistic                                                                                                                |   |   |        | 0.194                                                | <b>Lilliefors GOF Test</b>                           |                             |        |   |       |   |   |
| 2691 | 5% Lilliefors Critical Value                                                                                                             |   |   |        | 0.0911                                               | Detected Data Not Lognormal at 5% Significance Level |                             |        |   |       |   |   |
| 2692 | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                                              |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2693 |                                                                                                                                          |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2694 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2695 | Mean in Original Scale                                                                                                                   |   |   | 1.26   | Mean in Log Scale                                    |                                                      |                             | -0.596 |   |       |   |   |
| 2696 | SD in Original Scale                                                                                                                     |   |   | 2.406  | SD in Log Scale                                      |                                                      |                             | 1.214  |   |       |   |   |
| 2697 | 95% t UCL (assumes normality of ROS data)                                                                                                |   |   | 1.586  | 95% Percentile Bootstrap UCL                         |                                                      |                             | 1.607  |   |       |   |   |
| 2698 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 1.67   | 95% Bootstrap t UCL                                  |                                                      |                             | 1.704  |   |       |   |   |
| 2699 | 95% H-UCL (Log ROS)                                                                                                                      |   |   | 1.464  |                                                      |                                                      |                             |        |   |       |   |   |
| 2700 |                                                                                                                                          |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2701 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2702 | KM Mean (logged)                                                                                                                         |   |   | -0.672 | KM Geo Mean                                          |                                                      |                             | 0.51   |   |       |   |   |
| 2703 | KM SD (logged)                                                                                                                           |   |   | 1.234  | 95% Critical H Value (KM-Log)                        |                                                      |                             | 2.428  |   |       |   |   |
| 2704 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.102  | 95% H-UCL (KM -Log)                                  |                                                      |                             | 1.397  |   |       |   |   |
| 2705 | KM SD (logged)                                                                                                                           |   |   | 1.234  | 95% Critical H Value (KM-Log)                        |                                                      |                             | 2.428  |   |       |   |   |
| 2706 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.102  |                                                      |                                                      |                             |        |   |       |   |   |
| 2707 |                                                                                                                                          |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2708 | <b>DL/2 Statistics</b>                                                                                                                   |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2709 | <b>DL/2 Normal</b>                                                                                                                       |   |   |        |                                                      |                                                      | <b>DL/2 Log-Transformed</b> |        |   |       |   |   |
| 2710 | Mean in Original Scale                                                                                                                   |   |   | 1.282  | Mean in Log Scale                                    |                                                      |                             | -0.435 |   |       |   |   |
| 2711 | SD in Original Scale                                                                                                                     |   |   | 2.396  | SD in Log Scale                                      |                                                      |                             | 0.989  |   |       |   |   |
| 2712 | 95% t UCL (Assumes normality)                                                                                                            |   |   | 1.607  | 95% H-Stat UCL                                       |                                                      |                             | 1.262  |   |       |   |   |
| 2713 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2714 |                                                                                                                                          |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2715 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2716 | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                            |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2717 |                                                                                                                                          |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2718 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2719 | 95% KM (Chebyshev) UCL                                                                                                                   |   |   | 2.103  |                                                      |                                                      |                             |        |   |       |   |   |
| 2720 |                                                                                                                                          |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2721 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2722 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2723 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2724 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2725 |                                                                                                                                          |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2726 | <b>Result (eu8_chromium)</b>                                                                                                             |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2727 |                                                                                                                                          |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2728 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2729 | Total Number of Observations                                                                                                             |   |   | 149    | Number of Distinct Observations                      |                                                      |                             | 5      |   |       |   |   |
| 2730 | Number of Detects                                                                                                                        |   |   | 3      | Number of Non-Detects                                |                                                      |                             | 146    |   |       |   |   |
| 2731 | Number of Distinct Detects                                                                                                               |   |   | 3      | Number of Distinct Non-Detects                       |                                                      |                             | 2      |   |       |   |   |
| 2732 | Minimum Detect                                                                                                                           |   |   | 0.1    | Minimum Non-Detect                                   |                                                      |                             | 0.035  |   |       |   |   |
| 2733 | Maximum Detect                                                                                                                           |   |   | 0.4    | Maximum Non-Detect                                   |                                                      |                             | 5      |   |       |   |   |
| 2734 | Variance Detects                                                                                                                         |   |   | 0.029  | Percent Non-Detects                                  |                                                      |                             | 97.99% |   |       |   |   |
| 2735 | Mean Detects                                                                                                                             |   |   | 0.203  | SD Detects                                           |                                                      |                             | 0.17   |   |       |   |   |
| 2736 | Median Detects                                                                                                                           |   |   | 0.11   | CV Detects                                           |                                                      |                             | 0.838  |   |       |   |   |
| 2737 | Skewness Detects                                                                                                                         |   |   | 1.725  | Kurtosis Detects                                     |                                                      |                             | N/A    |   |       |   |   |
| 2738 | Mean of Logged Detects                                                                                                                   |   |   | -1.809 | SD of Logged Detects                                 |                                                      |                             | 0.774  |   |       |   |   |
| 2739 |                                                                                                                                          |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2740 | <b>Warning: Data set has only 3 Detected Values.</b>                                                                                     |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2741 | <b>This is not enough to compute meaningful or reliable statistics and estimates.</b>                                                    |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2742 |                                                                                                                                          |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2743 |                                                                                                                                          |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2744 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |   |        |                                                      |                                                      |                             |        |   |       |   |   |
| 2745 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.775  | <b>Shapiro Wilk GOF Test</b>                         |                                                      |                             |        |   |       |   |   |
| 2746 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.767  | Detected Data appear Normal at 5% Significance Level |                                                      |                             |        |   |       |   |   |
| 2747 | Lilliefors Test Statistic                                                                                                                |   |   | 0.375  | <b>Lilliefors GOF Test</b>                           |                                                      |                             |        |   |       |   |   |

|      | A                                                                                                                         | B | C | D       | E                                                       | F | G | H      | I | J | K | L |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|---------|---------------------------------------------------------|---|---|--------|---|---|---|---|
| 2748 | 5% Lilliefors Critical Value                                                                                              |   |   | 0.425   | Detected Data appear Normal at 5% Significance Level    |   |   |        |   |   |   |   |
| 2749 | Detected Data appear Normal at 5% Significance Level                                                                      |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2750 |                                                                                                                           |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2751 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2752 | KM Mean                                                                                                                   |   |   | 0.057   | KM Standard Error of Mean                               |   |   | 0.0193 |   |   |   |   |
| 2753 | KM SD                                                                                                                     |   |   | 0.0758  | 95% KM (BCA) UCL                                        |   |   | N/A    |   |   |   |   |
| 2754 | 95% KM (t) UCL                                                                                                            |   |   | 0.089   | 95% KM (Percentile Bootstrap) UCL                       |   |   | N/A    |   |   |   |   |
| 2755 | 95% KM (z) UCL                                                                                                            |   |   | 0.0888  | 95% KM Bootstrap t UCL                                  |   |   | N/A    |   |   |   |   |
| 2756 | 90% KM Chebyshev UCL                                                                                                      |   |   | 0.115   | 95% KM Chebyshev UCL                                    |   |   | 0.141  |   |   |   |   |
| 2757 | 97.5% KM Chebyshev UCL                                                                                                    |   |   | 0.178   | 99% KM Chebyshev UCL                                    |   |   | 0.249  |   |   |   |   |
| 2758 |                                                                                                                           |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2759 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2760 | Not Enough Data to Perform GOF Test                                                                                       |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2761 |                                                                                                                           |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2762 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2763 | k hat (MLE)                                                                                                               |   |   | 2.471   | k star (bias corrected MLE)                             |   |   | N/A    |   |   |   |   |
| 2764 | Theta hat (MLE)                                                                                                           |   |   | 0.0823  | Theta star (bias corrected MLE)                         |   |   | N/A    |   |   |   |   |
| 2765 | nu hat (MLE)                                                                                                              |   |   | 14.82   | nu star (bias corrected)                                |   |   | N/A    |   |   |   |   |
| 2766 | Mean (detects)                                                                                                            |   |   | 0.203   |                                                         |   |   |        |   |   |   |   |
| 2767 |                                                                                                                           |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2768 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2769 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2770 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2771 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2772 | This is especially true when the sample size is small.                                                                    |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2773 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2774 | Minimum                                                                                                                   |   |   | 0.01    | Mean                                                    |   |   | 0.0377 |   |   |   |   |
| 2775 | Maximum                                                                                                                   |   |   | 0.761   | Median                                                  |   |   | 0.01   |   |   |   |   |
| 2776 | SD                                                                                                                        |   |   | 0.103   | CV                                                      |   |   | 2.731  |   |   |   |   |
| 2777 | k hat (MLE)                                                                                                               |   |   | 0.615   | k star (bias corrected MLE)                             |   |   | 0.607  |   |   |   |   |
| 2778 | Theta hat (MLE)                                                                                                           |   |   | 0.0614  | Theta star (bias corrected MLE)                         |   |   | 0.0622 |   |   |   |   |
| 2779 | nu hat (MLE)                                                                                                              |   |   | 183.3   | nu star (bias corrected)                                |   |   | 180.9  |   |   |   |   |
| 2780 | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   | 0.0484  |                                                         |   |   |        |   |   |   |   |
| 2781 | Approximate Chi Square Value (180.91, $\alpha$ )                                                                          |   |   | 150.8   | Adjusted Chi Square Value (180.91, $\beta$ )            |   |   | 150.5  |   |   |   |   |
| 2782 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   | 0.0453  | 95% Gamma Adjusted UCL (use when $n < 50$ )             |   |   | N/A    |   |   |   |   |
| 2783 |                                                                                                                           |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2784 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2785 | Mean (KM)                                                                                                                 |   |   | 0.057   | SD (KM)                                                 |   |   | 0.0758 |   |   |   |   |
| 2786 | Variance (KM)                                                                                                             |   |   | 0.00574 | SE of Mean (KM)                                         |   |   | 0.0193 |   |   |   |   |
| 2787 | k hat (KM)                                                                                                                |   |   | 0.565   | k star (KM)                                             |   |   | 0.558  |   |   |   |   |
| 2788 | nu hat (KM)                                                                                                               |   |   | 168.5   | nu star (KM)                                            |   |   | 166.4  |   |   |   |   |
| 2789 | theta hat (KM)                                                                                                            |   |   | 0.101   | theta star (KM)                                         |   |   | 0.102  |   |   |   |   |
| 2790 | 80% gamma percentile (KM)                                                                                                 |   |   | 0.0938  | 90% gamma percentile (KM)                               |   |   | 0.151  |   |   |   |   |
| 2791 | 95% gamma percentile (KM)                                                                                                 |   |   | 0.21    | 99% gamma percentile (KM)                               |   |   | 0.356  |   |   |   |   |
| 2792 |                                                                                                                           |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2793 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2794 | Approximate Chi Square Value (166.40, $\alpha$ )                                                                          |   |   | 137.6   | Adjusted Chi Square Value (166.40, $\beta$ )            |   |   | 137.3  |   |   |   |   |
| 2795 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   |   | 0.0689  | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )          |   |   | 0.069  |   |   |   |   |
| 2796 |                                                                                                                           |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2797 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2798 | Shapiro Wilk Test Statistic                                                                                               |   |   | 0.801   | <b>Shapiro Wilk GOF Test</b>                            |   |   |        |   |   |   |   |
| 2799 | 5% Shapiro Wilk Critical Value                                                                                            |   |   | 0.767   | Detected Data appear Lognormal at 5% Significance Level |   |   |        |   |   |   |   |
| 2800 | Lilliefors Test Statistic                                                                                                 |   |   | 0.363   | <b>Lilliefors GOF Test</b>                              |   |   |        |   |   |   |   |
| 2801 | 5% Lilliefors Critical Value                                                                                              |   |   | 0.425   | Detected Data appear Lognormal at 5% Significance Level |   |   |        |   |   |   |   |
| 2802 | Detected Data appear Lognormal at 5% Significance Level                                                                   |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2803 |                                                                                                                           |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2804 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2805 | Mean in Original Scale                                                                                                    |   |   | 0.0423  | Mean in Log Scale                                       |   |   | -5.887 |   |   |   |   |
| 2806 | SD in Original Scale                                                                                                      |   |   | 0.16    | SD in Log Scale                                         |   |   | 2.532  |   |   |   |   |
| 2807 | 95% t UCL (assumes normality of ROS data)                                                                                 |   |   | 0.0639  | 95% Percentile Bootstrap UCL                            |   |   | 0.067  |   |   |   |   |
| 2808 | 95% BCA Bootstrap UCL                                                                                                     |   |   | 0.0771  | 95% Bootstrap t UCL                                     |   |   | 0.0843 |   |   |   |   |
| 2809 | 95% H-UCL (Log ROS)                                                                                                       |   |   | 0.156   |                                                         |   |   |        |   |   |   |   |
| 2810 |                                                                                                                           |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2811 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |   |   |         |                                                         |   |   |        |   |   |   |   |
| 2812 | KM Mean (logged)                                                                                                          |   |   | -3.151  | KM Geo Mean                                             |   |   | 0.0428 |   |   |   |   |
| 2813 | KM SD (logged)                                                                                                            |   |   | 0.568   | 95% Critical H Value (KM-Log)                           |   |   | 1.871  |   |   |   |   |
| 2814 | KM Standard Error of Mean (logged)                                                                                        |   |   | 0.145   | 95% H-UCL (KM -Log)                                     |   |   | 0.0549 |   |   |   |   |

| A    | B | C | D | E | F                                                                                                                                        | G     | H | I                           | J | K                                                               | L     |
|------|---|---|---|---|------------------------------------------------------------------------------------------------------------------------------------------|-------|---|-----------------------------|---|-----------------------------------------------------------------|-------|
| 2815 |   |   |   |   | KM SD (logged)                                                                                                                           | 0.568 |   |                             |   | 95% Critical H Value (KM-Log)                                   | 1.871 |
| 2816 |   |   |   |   | KM Standard Error of Mean (logged)                                                                                                       | 0.145 |   |                             |   |                                                                 |       |
| 2817 |   |   |   |   |                                                                                                                                          |       |   |                             |   |                                                                 |       |
| 2818 |   |   |   |   | <b>DL/2 Statistics</b>                                                                                                                   |       |   |                             |   |                                                                 |       |
| 2819 |   |   |   |   | <b>DL/2 Normal</b>                                                                                                                       |       |   | <b>DL/2 Log-Transformed</b> |   |                                                                 |       |
| 2820 |   |   |   |   | Mean in Original Scale                                                                                                                   | 2.121 |   |                             |   | Mean in Log Scale                                               | 0.195 |
| 2821 |   |   |   |   | SD in Original Scale                                                                                                                     | 0.892 |   |                             |   | SD in Log Scale                                                 | 1.721 |
| 2822 |   |   |   |   | 95% t UCL (Assumes normality)                                                                                                            | 2.241 |   |                             |   | 95% H-Stat UCL                                                  | 8.13  |
| 2823 |   |   |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |       |   |                             |   |                                                                 |       |
| 2824 |   |   |   |   |                                                                                                                                          |       |   |                             |   |                                                                 |       |
| 2825 |   |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |       |   |                             |   |                                                                 |       |
| 2826 |   |   |   |   | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                  |       |   |                             |   |                                                                 |       |
| 2827 |   |   |   |   |                                                                                                                                          |       |   |                             |   |                                                                 |       |
| 2828 |   |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |       |   |                             |   |                                                                 |       |
| 2829 |   |   |   |   | 95% KM (t) UCL                                                                                                                           | 0.089 |   |                             |   |                                                                 |       |
| 2830 |   |   |   |   |                                                                                                                                          |       |   |                             |   |                                                                 |       |
| 2831 |   |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |       |   |                             |   |                                                                 |       |
| 2832 |   |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |       |   |                             |   |                                                                 |       |
| 2833 |   |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |       |   |                             |   |                                                                 |       |
| 2834 |   |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |       |   |                             |   |                                                                 |       |
| 2835 |   |   |   |   |                                                                                                                                          |       |   |                             |   |                                                                 |       |
| 2836 |   |   |   |   | <b>Result (eu8_cobalt)</b>                                                                                                               |       |   |                             |   |                                                                 |       |
| 2837 |   |   |   |   |                                                                                                                                          |       |   |                             |   |                                                                 |       |
| 2838 |   |   |   |   | <b>General Statistics</b>                                                                                                                |       |   |                             |   |                                                                 |       |
| 2839 |   |   |   |   | Total Number of Observations                                                                                                             | 50    |   |                             |   | Number of Distinct Observations                                 | 37    |
| 2840 |   |   |   |   | Number of Detects                                                                                                                        | 38    |   |                             |   | Number of Non-Detects                                           | 12    |
| 2841 |   |   |   |   | Number of Distinct Detects                                                                                                               | 36    |   |                             |   | Number of Distinct Non-Detects                                  | 1     |
| 2842 |   |   |   |   | Minimum Detect                                                                                                                           | 0.06  |   |                             |   | Minimum Non-Detect                                              | 0.5   |
| 2843 |   |   |   |   | Maximum Detect                                                                                                                           | 27    |   |                             |   | Maximum Non-Detect                                              | 0.5   |
| 2844 |   |   |   |   | Variance Detects                                                                                                                         | 54.52 |   |                             |   | Percent Non-Detects                                             | 24%   |
| 2845 |   |   |   |   | Mean Detects                                                                                                                             | 6.366 |   |                             |   | SD Detects                                                      | 7.384 |
| 2846 |   |   |   |   | Median Detects                                                                                                                           | 2.41  |   |                             |   | CV Detects                                                      | 1.16  |
| 2847 |   |   |   |   | Skewness Detects                                                                                                                         | 1.519 |   |                             |   | Kurtosis Detects                                                | 1.761 |
| 2848 |   |   |   |   | Mean of Logged Detects                                                                                                                   | 1.034 |   |                             |   | SD of Logged Detects                                            | 1.475 |
| 2849 |   |   |   |   |                                                                                                                                          |       |   |                             |   |                                                                 |       |
| 2850 |   |   |   |   | <b>Normal GOF Test on Detects Only</b>                                                                                                   |       |   |                             |   |                                                                 |       |
| 2851 |   |   |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.779 |   |                             |   | <b>Shapiro Wilk GOF Test</b>                                    |       |
| 2852 |   |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                           | 0.938 |   |                             |   | Detected Data Not Normal at 5% Significance Level               |       |
| 2853 |   |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.227 |   |                             |   | <b>Lilliefors GOF Test</b>                                      |       |
| 2854 |   |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.142 |   |                             |   | Detected Data Not Normal at 5% Significance Level               |       |
| 2855 |   |   |   |   | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |       |   |                             |   |                                                                 |       |
| 2856 |   |   |   |   |                                                                                                                                          |       |   |                             |   |                                                                 |       |
| 2857 |   |   |   |   | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |       |   |                             |   |                                                                 |       |
| 2858 |   |   |   |   | KM Mean                                                                                                                                  | 4.903 |   |                             |   | KM Standard Error of Mean                                       | 0.984 |
| 2859 |   |   |   |   | KM SD                                                                                                                                    | 6.864 |   |                             |   | 95% KM (BCA) UCL                                                | 6.584 |
| 2860 |   |   |   |   | 95% KM (t) UCL                                                                                                                           | 6.553 |   |                             |   | 95% KM (Percentile Bootstrap) UCL                               | 6.584 |
| 2861 |   |   |   |   | 95% KM (z) UCL                                                                                                                           | 6.522 |   |                             |   | 95% KM Bootstrap t UCL                                          | 6.949 |
| 2862 |   |   |   |   | 90% KM Chebyshev UCL                                                                                                                     | 7.856 |   |                             |   | 95% KM Chebyshev UCL                                            | 9.193 |
| 2863 |   |   |   |   | 97.5% KM Chebyshev UCL                                                                                                                   | 11.05 |   |                             |   | 99% KM Chebyshev UCL                                            | 14.69 |
| 2864 |   |   |   |   |                                                                                                                                          |       |   |                             |   |                                                                 |       |
| 2865 |   |   |   |   | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |       |   |                             |   |                                                                 |       |
| 2866 |   |   |   |   | A-D Test Statistic                                                                                                                       | 0.656 |   |                             |   | <b>Anderson-Darling GOF Test</b>                                |       |
| 2867 |   |   |   |   | 5% A-D Critical Value                                                                                                                    | 0.79  |   |                             |   | Detected data appear Gamma Distributed at 5% Significance Level |       |
| 2868 |   |   |   |   | K-S Test Statistic                                                                                                                       | 0.14  |   |                             |   | <b>Kolmogorov-Smirnov GOF</b>                                   |       |
| 2869 |   |   |   |   | 5% K-S Critical Value                                                                                                                    | 0.149 |   |                             |   | Detected data appear Gamma Distributed at 5% Significance Level |       |
| 2870 |   |   |   |   | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                                   |       |   |                             |   |                                                                 |       |
| 2871 |   |   |   |   |                                                                                                                                          |       |   |                             |   |                                                                 |       |
| 2872 |   |   |   |   | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |       |   |                             |   |                                                                 |       |
| 2873 |   |   |   |   | k hat (MLE)                                                                                                                              | 0.735 |   |                             |   | k star (bias corrected MLE)                                     | 0.694 |
| 2874 |   |   |   |   | Theta hat (MLE)                                                                                                                          | 8.665 |   |                             |   | Theta star (bias corrected MLE)                                 | 9.17  |
| 2875 |   |   |   |   | nu hat (MLE)                                                                                                                             | 55.83 |   |                             |   | nu star (bias corrected)                                        | 52.76 |
| 2876 |   |   |   |   | Mean (detects)                                                                                                                           | 6.366 |   |                             |   |                                                                 |       |
| 2877 |   |   |   |   |                                                                                                                                          |       |   |                             |   |                                                                 |       |
| 2878 |   |   |   |   | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |       |   |                             |   |                                                                 |       |
| 2879 |   |   |   |   | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |       |   |                             |   |                                                                 |       |
| 2880 |   |   |   |   | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |       |   |                             |   |                                                                 |       |
| 2881 |   |   |   |   | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |       |   |                             |   |                                                                 |       |

| A    | B                                                                                                                                        | C      | D                                                       | E                                              | F     | G                           | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------|---------------------------------------------------------|------------------------------------------------|-------|-----------------------------|---|---|---|---|---|
| 2882 | This is especially true when the sample size is small.                                                                                   |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2883 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2884 | Minimum                                                                                                                                  | 0.01   |                                                         | Mean                                           | 4.84  |                             |   |   |   |   |   |
| 2885 | Maximum                                                                                                                                  | 27     |                                                         | Median                                         | 1.24  |                             |   |   |   |   |   |
| 2886 | SD                                                                                                                                       | 6.977  |                                                         | CV                                             | 1.442 |                             |   |   |   |   |   |
| 2887 | k hat (MLE)                                                                                                                              | 0.354  |                                                         | k star (bias corrected MLE)                    | 0.346 |                             |   |   |   |   |   |
| 2888 | Theta hat (MLE)                                                                                                                          | 13.68  |                                                         | Theta star (bias corrected MLE)                | 13.99 |                             |   |   |   |   |   |
| 2889 | nu hat (MLE)                                                                                                                             | 35.39  |                                                         | nu star (bias corrected)                       | 34.6  |                             |   |   |   |   |   |
| 2890 | Adjusted Level of Significance ( $\beta$ )                                                                                               | 0.0452 |                                                         |                                                |       |                             |   |   |   |   |   |
| 2891 | Approximate Chi Square Value (34.60, $\alpha$ )                                                                                          | 22.15  |                                                         | Adjusted Chi Square Value (34.60, $\beta$ )    | 21.85 |                             |   |   |   |   |   |
| 2892 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                                        | 7.563  |                                                         | 95% Gamma Adjusted UCL (use when $n < 50$ )    | 7.666 |                             |   |   |   |   |   |
| 2893 |                                                                                                                                          |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2894 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2895 | Mean (KM)                                                                                                                                | 4.903  |                                                         | SD (KM)                                        | 6.864 |                             |   |   |   |   |   |
| 2896 | Variance (KM)                                                                                                                            | 47.12  |                                                         | SE of Mean (KM)                                | 0.984 |                             |   |   |   |   |   |
| 2897 | k hat (KM)                                                                                                                               | 0.51   |                                                         | k star (KM)                                    | 0.493 |                             |   |   |   |   |   |
| 2898 | nu hat (KM)                                                                                                                              | 51.03  |                                                         | nu star (KM)                                   | 49.3  |                             |   |   |   |   |   |
| 2899 | theta hat (KM)                                                                                                                           | 9.61   |                                                         | theta star (KM)                                | 9.947 |                             |   |   |   |   |   |
| 2900 | 80% gamma percentile (KM)                                                                                                                | 8.048  |                                                         | 90% gamma percentile (KM)                      | 13.31 |                             |   |   |   |   |   |
| 2901 | 95% gamma percentile (KM)                                                                                                                | 18.93  |                                                         | 99% gamma percentile (KM)                      | 32.79 |                             |   |   |   |   |   |
| 2902 |                                                                                                                                          |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2903 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2904 | Approximate Chi Square Value (49.30, $\alpha$ )                                                                                          | 34.18  |                                                         | Adjusted Chi Square Value (49.30, $\beta$ )    | 33.8  |                             |   |   |   |   |   |
| 2905 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                      | 7.073  |                                                         | 95% Gamma Adjusted KM-UCL (use when $n < 50$ ) | 7.151 |                             |   |   |   |   |   |
| 2906 |                                                                                                                                          |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2907 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2908 | Shapiro Wilk Test Statistic                                                                                                              | 0.956  |                                                         | <b>Shapiro Wilk GOF Test</b>                   |       |                             |   |   |   |   |   |
| 2909 | 5% Shapiro Wilk Critical Value                                                                                                           | 0.938  | Detected Data appear Lognormal at 5% Significance Level |                                                |       |                             |   |   |   |   |   |
| 2910 | Lilliefors Test Statistic                                                                                                                | 0.145  |                                                         | <b>Lilliefors GOF Test</b>                     |       |                             |   |   |   |   |   |
| 2911 | 5% Lilliefors Critical Value                                                                                                             | 0.142  | Detected Data Not Lognormal at 5% Significance Level    |                                                |       |                             |   |   |   |   |   |
| 2912 | <b>Detected Data appear Approximate Lognormal at 5% Significance Level</b>                                                               |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2913 |                                                                                                                                          |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2914 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2915 | Mean in Original Scale                                                                                                                   | 4.901  |                                                         | Mean in Log Scale                              | 0.405 |                             |   |   |   |   |   |
| 2916 | SD in Original Scale                                                                                                                     | 6.936  |                                                         | SD in Log Scale                                | 1.751 |                             |   |   |   |   |   |
| 2917 | 95% t UCL (assumes normality of ROS data)                                                                                                | 6.546  |                                                         | 95% Percentile Bootstrap UCL                   | 6.534 |                             |   |   |   |   |   |
| 2918 | 95% BCA Bootstrap UCL                                                                                                                    | 6.838  |                                                         | 95% Bootstrap t UCL                            | 6.946 |                             |   |   |   |   |   |
| 2919 | 95% H-UCL (Log ROS)                                                                                                                      | 15.77  |                                                         |                                                |       |                             |   |   |   |   |   |
| 2920 |                                                                                                                                          |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2921 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2922 | KM Mean (logged)                                                                                                                         | 0.417  |                                                         | KM Geo Mean                                    | 1.517 |                             |   |   |   |   |   |
| 2923 | KM SD (logged)                                                                                                                           | 1.721  |                                                         | 95% Critical H Value (KM-Log)                  | 3.234 |                             |   |   |   |   |   |
| 2924 | KM Standard Error of Mean (logged)                                                                                                       | 0.27   |                                                         | 95% H-UCL (KM -Log)                            | 14.77 |                             |   |   |   |   |   |
| 2925 | KM SD (logged)                                                                                                                           | 1.721  |                                                         | 95% Critical H Value (KM-Log)                  | 3.234 |                             |   |   |   |   |   |
| 2926 | KM Standard Error of Mean (logged)                                                                                                       | 0.27   |                                                         |                                                |       |                             |   |   |   |   |   |
| 2927 |                                                                                                                                          |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2928 | <b>DL/2 Statistics</b>                                                                                                                   |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2929 | <b>DL/2 Normal</b>                                                                                                                       |        |                                                         |                                                |       | <b>DL/2 Log-Transformed</b> |   |   |   |   |   |
| 2930 | Mean in Original Scale                                                                                                                   | 4.898  |                                                         | Mean in Log Scale                              | 0.453 |                             |   |   |   |   |   |
| 2931 | SD in Original Scale                                                                                                                     | 6.937  |                                                         | SD in Log Scale                                | 1.653 |                             |   |   |   |   |   |
| 2932 | 95% t UCL (Assumes normality)                                                                                                            | 6.543  |                                                         | 95% H-Stat UCL                                 | 12.97 |                             |   |   |   |   |   |
| 2933 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2934 |                                                                                                                                          |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2935 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2936 | <b>Detected Data appear Gamma Distributed at 5% Significance Level</b>                                                                   |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2937 |                                                                                                                                          |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2938 | <b>Suggested UCL to Use</b>                                                                                                              |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2939 | 95% KM Approximate Gamma UCL                                                                                                             | 7.073  |                                                         |                                                |       |                             |   |   |   |   |   |
| 2940 |                                                                                                                                          |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2941 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2942 | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2943 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2944 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2945 |                                                                                                                                          |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2946 | <b>Result (eu8_copper)</b>                                                                                                               |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2947 |                                                                                                                                          |        |                                                         |                                                |       |                             |   |   |   |   |   |
| 2948 | <b>General Statistics</b>                                                                                                                |        |                                                         |                                                |       |                             |   |   |   |   |   |

|      | A                                                                                                                         | B | C | D | E      | F                                                            | G | H | I | J      | K | L |  |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|---|--------|--------------------------------------------------------------|---|---|---|--------|---|---|--|
| 2949 | Total Number of Observations                                                                                              |   |   |   | 149    | Number of Distinct Observations                              |   |   |   | 128    |   |   |  |
| 2950 | Number of Detects                                                                                                         |   |   |   | 141    | Number of Non-Detects                                        |   |   |   | 8      |   |   |  |
| 2951 | Number of Distinct Detects                                                                                                |   |   |   | 126    | Number of Distinct Non-Detects                               |   |   |   | 2      |   |   |  |
| 2952 | Minimum Detect                                                                                                            |   |   |   | 3.05   | Minimum Non-Detect                                           |   |   |   | 0.073  |   |   |  |
| 2953 | Maximum Detect                                                                                                            |   |   |   | 318    | Maximum Non-Detect                                           |   |   |   | 2.5    |   |   |  |
| 2954 | Variance Detects                                                                                                          |   |   |   | 3029   | Percent Non-Detects                                          |   |   |   | 5.369% |   |   |  |
| 2955 | Mean Detects                                                                                                              |   |   |   | 28.51  | SD Detects                                                   |   |   |   | 55.03  |   |   |  |
| 2956 | Median Detects                                                                                                            |   |   |   | 11.8   | CV Detects                                                   |   |   |   | 1.931  |   |   |  |
| 2957 | Skewness Detects                                                                                                          |   |   |   | 3.816  | Kurtosis Detects                                             |   |   |   | 14.59  |   |   |  |
| 2958 | Mean of Logged Detects                                                                                                    |   |   |   | 2.647  | SD of Logged Detects                                         |   |   |   | 0.978  |   |   |  |
| 2959 |                                                                                                                           |   |   |   |        |                                                              |   |   |   |        |   |   |  |
| 2960 | <b>Normal GOF Test on Detects Only</b>                                                                                    |   |   |   |        |                                                              |   |   |   |        |   |   |  |
| 2961 | Shapiro Wilk Test Statistic                                                                                               |   |   |   | 0.442  | <b>Normal GOF Test on Detected Observations Only</b>         |   |   |   |        |   |   |  |
| 2962 | 5% Shapiro Wilk P Value                                                                                                   |   |   |   | 0      | Detected Data Not Normal at 5% Significance Level            |   |   |   |        |   |   |  |
| 2963 | Lilliefors Test Statistic                                                                                                 |   |   |   | 0.343  | <b>Lilliefors GOF Test</b>                                   |   |   |   |        |   |   |  |
| 2964 | 5% Lilliefors Critical Value                                                                                              |   |   |   | 0.075  | Detected Data Not Normal at 5% Significance Level            |   |   |   |        |   |   |  |
| 2965 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                  |   |   |   |        |                                                              |   |   |   |        |   |   |  |
| 2966 |                                                                                                                           |   |   |   |        |                                                              |   |   |   |        |   |   |  |
| 2967 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |   |   |   |        |                                                              |   |   |   |        |   |   |  |
| 2968 | KM Mean                                                                                                                   |   |   |   | 26.98  | KM Standard Error of Mean                                    |   |   |   | 4.417  |   |   |  |
| 2969 | KM SD                                                                                                                     |   |   |   | 53.73  | 95% KM (BCA) UCL                                             |   |   |   | 35.36  |   |   |  |
| 2970 | 95% KM (t) UCL                                                                                                            |   |   |   | 34.29  | 95% KM (Percentile Bootstrap) UCL                            |   |   |   | 34.56  |   |   |  |
| 2971 | 95% KM (z) UCL                                                                                                            |   |   |   | 34.25  | 95% KM Bootstrap t UCL                                       |   |   |   | 36.53  |   |   |  |
| 2972 | 90% KM Chebyshev UCL                                                                                                      |   |   |   | 40.23  | 95% KM Chebyshev UCL                                         |   |   |   | 46.24  |   |   |  |
| 2973 | 97.5% KM Chebyshev UCL                                                                                                    |   |   |   | 54.57  | 99% KM Chebyshev UCL                                         |   |   |   | 70.93  |   |   |  |
| 2974 |                                                                                                                           |   |   |   |        |                                                              |   |   |   |        |   |   |  |
| 2975 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |   |        |                                                              |   |   |   |        |   |   |  |
| 2976 | A-D Test Statistic                                                                                                        |   |   |   | 13.36  | <b>Anderson-Darling GOF Test</b>                             |   |   |   |        |   |   |  |
| 2977 | 5% A-D Critical Value                                                                                                     |   |   |   | 0.791  | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |   |        |   |   |  |
| 2978 | K-S Test Statistic                                                                                                        |   |   |   | 0.255  | <b>Kolmogorov-Smirnov GOF</b>                                |   |   |   |        |   |   |  |
| 2979 | 5% K-S Critical Value                                                                                                     |   |   |   | 0.0817 | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |   |        |   |   |  |
| 2980 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                       |   |   |   |        |                                                              |   |   |   |        |   |   |  |
| 2981 |                                                                                                                           |   |   |   |        |                                                              |   |   |   |        |   |   |  |
| 2982 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |   |        |                                                              |   |   |   |        |   |   |  |
| 2983 | k hat (MLE)                                                                                                               |   |   |   | 0.838  | k star (bias corrected MLE)                                  |   |   |   | 0.825  |   |   |  |
| 2984 | Theta hat (MLE)                                                                                                           |   |   |   | 34     | Theta star (bias corrected MLE)                              |   |   |   | 34.54  |   |   |  |
| 2985 | nu hat (MLE)                                                                                                              |   |   |   | 236.4  | nu star (bias corrected)                                     |   |   |   | 232.7  |   |   |  |
| 2986 | Mean (detects)                                                                                                            |   |   |   | 28.51  |                                                              |   |   |   |        |   |   |  |
| 2987 |                                                                                                                           |   |   |   |        |                                                              |   |   |   |        |   |   |  |
| 2988 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |   |        |                                                              |   |   |   |        |   |   |  |
| 2989 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |   |        |                                                              |   |   |   |        |   |   |  |
| 2990 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |   |        |                                                              |   |   |   |        |   |   |  |
| 2991 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |   |        |                                                              |   |   |   |        |   |   |  |
| 2992 | This is especially true when the sample size is small.                                                                    |   |   |   |        |                                                              |   |   |   |        |   |   |  |
| 2993 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |   |        |                                                              |   |   |   |        |   |   |  |
| 2994 | Minimum                                                                                                                   |   |   |   | 0.01   | Mean                                                         |   |   |   | 26.98  |   |   |  |
| 2995 | Maximum                                                                                                                   |   |   |   | 318    | Median                                                       |   |   |   | 11.2   |   |   |  |
| 2996 | SD                                                                                                                        |   |   |   | 53.91  | CV                                                           |   |   |   | 1.998  |   |   |  |
| 2997 | k hat (MLE)                                                                                                               |   |   |   | 0.596  | k star (bias corrected MLE)                                  |   |   |   | 0.588  |   |   |  |
| 2998 | Theta hat (MLE)                                                                                                           |   |   |   | 45.27  | Theta star (bias corrected MLE)                              |   |   |   | 45.85  |   |   |  |
| 2999 | nu hat (MLE)                                                                                                              |   |   |   | 177.6  | nu star (bias corrected)                                     |   |   |   | 175.4  |   |   |  |
| 3000 | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   |   | 0.0484 |                                                              |   |   |   |        |   |   |  |
| 3001 | Approximate Chi Square Value (175.35, $\alpha$ )                                                                          |   |   |   | 145.7  | Adjusted Chi Square Value (175.35, $\beta$ )                 |   |   |   | 145.5  |   |   |  |
| 3002 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   |   | 32.46  | 95% Gamma Adjusted UCL (use when $n < 50$ )                  |   |   |   | 32.52  |   |   |  |
| 3003 |                                                                                                                           |   |   |   |        |                                                              |   |   |   |        |   |   |  |
| 3004 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |   |        |                                                              |   |   |   |        |   |   |  |
| 3005 | Mean (KM)                                                                                                                 |   |   |   | 26.98  | SD (KM)                                                      |   |   |   | 53.73  |   |   |  |
| 3006 | Variance (KM)                                                                                                             |   |   |   | 2887   | SE of Mean (KM)                                              |   |   |   | 4.417  |   |   |  |
| 3007 | k hat (KM)                                                                                                                |   |   |   | 0.252  | k star (KM)                                                  |   |   |   | 0.252  |   |   |  |
| 3008 | nu hat (KM)                                                                                                               |   |   |   | 75.14  | nu star (KM)                                                 |   |   |   | 74.96  |   |   |  |
| 3009 | theta hat (KM)                                                                                                            |   |   |   | 107    | theta star (KM)                                              |   |   |   | 107.3  |   |   |  |
| 3010 | 80% gamma percentile (KM)                                                                                                 |   |   |   | 39.27  | 90% gamma percentile (KM)                                    |   |   |   | 80.95  |   |   |  |
| 3011 | 95% gamma percentile (KM)                                                                                                 |   |   |   | 130.4  | 99% gamma percentile (KM)                                    |   |   |   | 261.8  |   |   |  |
| 3012 |                                                                                                                           |   |   |   |        |                                                              |   |   |   |        |   |   |  |
| 3013 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |   |        |                                                              |   |   |   |        |   |   |  |
| 3014 | Approximate Chi Square Value (74.96, $\alpha$ )                                                                           |   |   |   | 56.02  | Adjusted Chi Square Value (74.96, $\beta$ )                  |   |   |   | 55.86  |   |   |  |
| 3015 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   |   |   | 36.1   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )               |   |   |   | 36.21  |   |   |  |

|      | A                                                                                                                                        | B | C | D | E       | F | G                                                    | H | I | J | K      | L |  |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---------|---|------------------------------------------------------|---|---|---|--------|---|--|--|
| 3016 |                                                                                                                                          |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3017 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3018 | Shapiro Wilk Approximate Test Statistic                                                                                                  |   |   |   | 0.872   |   | <b>Shapiro Wilk GOF Test</b>                         |   |   |   |        |   |  |  |
| 3019 | 5% Shapiro Wilk P Value                                                                                                                  |   |   |   | 0       |   | Detected Data Not Lognormal at 5% Significance Level |   |   |   |        |   |  |  |
| 3020 | Lilliefors Test Statistic                                                                                                                |   |   |   | 0.146   |   | <b>Lilliefors GOF Test</b>                           |   |   |   |        |   |  |  |
| 3021 | 5% Lilliefors Critical Value                                                                                                             |   |   |   | 0.075   |   | Detected Data Not Lognormal at 5% Significance Level |   |   |   |        |   |  |  |
| 3022 | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                                              |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3023 |                                                                                                                                          |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3024 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3025 | Mean in Original Scale                                                                                                                   |   |   |   | 27.06   |   | Mean in Log Scale                                    |   |   |   | 2.527  |   |  |  |
| 3026 | SD in Original Scale                                                                                                                     |   |   |   | 53.87   |   | SD in Log Scale                                      |   |   |   | 1.079  |   |  |  |
| 3027 | 95% t UCL (assumes normality of ROS data)                                                                                                |   |   |   | 34.37   |   | 95% Percentile Bootstrap UCL                         |   |   |   | 34.67  |   |  |  |
| 3028 | 95% BCA Bootstrap UCL                                                                                                                    |   |   |   | 36.72   |   | 95% Bootstrap t UCL                                  |   |   |   | 37.2   |   |  |  |
| 3029 | 95% H-UCL (Log ROS)                                                                                                                      |   |   |   | 27.4    |   |                                                      |   |   |   |        |   |  |  |
| 3030 |                                                                                                                                          |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3031 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3032 | KM Mean (logged)                                                                                                                         |   |   |   | 2.364   |   | KM Geo Mean                                          |   |   |   | 10.63  |   |  |  |
| 3033 | KM SD (logged)                                                                                                                           |   |   |   | 1.519   |   | 95% Critical H Value (KM-Log)                        |   |   |   | 2.733  |   |  |  |
| 3034 | KM Standard Error of Mean (logged)                                                                                                       |   |   |   | 0.125   |   | 95% H-UCL (KM -Log)                                  |   |   |   | 47.4   |   |  |  |
| 3035 | KM SD (logged)                                                                                                                           |   |   |   | 1.519   |   | 95% Critical H Value (KM-Log)                        |   |   |   | 2.733  |   |  |  |
| 3036 | KM Standard Error of Mean (logged)                                                                                                       |   |   |   | 0.125   |   |                                                      |   |   |   |        |   |  |  |
| 3037 |                                                                                                                                          |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3038 | <b>DL/2 Statistics</b>                                                                                                                   |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3039 | <b>DL/2 Normal</b>                                                                                                                       |   |   |   |         |   | <b>DL/2 Log-Transformed</b>                          |   |   |   |        |   |  |  |
| 3040 | Mean in Original Scale                                                                                                                   |   |   |   | 27.04   |   | Mean in Log Scale                                    |   |   |   | 2.493  |   |  |  |
| 3041 | SD in Original Scale                                                                                                                     |   |   |   | 53.88   |   | SD in Log Scale                                      |   |   |   | 1.183  |   |  |  |
| 3042 | 95% t UCL (Assumes normality)                                                                                                            |   |   |   | 34.34   |   | 95% H-Stat UCL                                       |   |   |   | 30.68  |   |  |  |
| 3043 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3044 |                                                                                                                                          |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3045 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3046 | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                            |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3047 |                                                                                                                                          |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3048 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3049 | 95% KM (Chebyshev) UCL                                                                                                                   |   |   |   | 46.24   |   |                                                      |   |   |   |        |   |  |  |
| 3050 |                                                                                                                                          |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3051 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3052 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3053 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3054 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3055 |                                                                                                                                          |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3056 | <b>Result (eu8_iron)</b>                                                                                                                 |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3057 |                                                                                                                                          |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3058 | <b>General Statistics</b>                                                                                                                |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3059 | Total Number of Observations                                                                                                             |   |   |   | 149     |   | Number of Distinct Observations                      |   |   |   | 132    |   |  |  |
| 3060 | Number of Detects                                                                                                                        |   |   |   | 134     |   | Number of Non-Detects                                |   |   |   | 15     |   |  |  |
| 3061 | Number of Distinct Detects                                                                                                               |   |   |   | 130     |   | Number of Distinct Non-Detects                       |   |   |   | 2      |   |  |  |
| 3062 | Minimum Detect                                                                                                                           |   |   |   | 106     |   | Minimum Non-Detect                                   |   |   |   | 2.1    |   |  |  |
| 3063 | Maximum Detect                                                                                                                           |   |   |   | 16900   |   | Maximum Non-Detect                                   |   |   |   | 100    |   |  |  |
| 3064 | Variance Detects                                                                                                                         |   |   |   | 8656881 |   | Percent Non-Detects                                  |   |   |   | 10.07% |   |  |  |
| 3065 | Mean Detects                                                                                                                             |   |   |   | 2423    |   | SD Detects                                           |   |   |   | 2942   |   |  |  |
| 3066 | Median Detects                                                                                                                           |   |   |   | 1380    |   | CV Detects                                           |   |   |   | 1.214  |   |  |  |
| 3067 | Skewness Detects                                                                                                                         |   |   |   | 2.197   |   | Kurtosis Detects                                     |   |   |   | 6.1    |   |  |  |
| 3068 | Mean of Logged Detects                                                                                                                   |   |   |   | 7.07    |   | SD of Logged Detects                                 |   |   |   | 1.283  |   |  |  |
| 3069 |                                                                                                                                          |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3070 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3071 | Shapiro Wilk Test Statistic                                                                                                              |   |   |   | 0.751   |   | <b>Normal GOF Test on Detected Observations Only</b> |   |   |   |        |   |  |  |
| 3072 | 5% Shapiro Wilk P Value                                                                                                                  |   |   |   | 0       |   | Detected Data Not Normal at 5% Significance Level    |   |   |   |        |   |  |  |
| 3073 | Lilliefors Test Statistic                                                                                                                |   |   |   | 0.215   |   | <b>Lilliefors GOF Test</b>                           |   |   |   |        |   |  |  |
| 3074 | 5% Lilliefors Critical Value                                                                                                             |   |   |   | 0.0769  |   | Detected Data Not Normal at 5% Significance Level    |   |   |   |        |   |  |  |
| 3075 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3076 |                                                                                                                                          |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3077 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |   |   |         |   |                                                      |   |   |   |        |   |  |  |
| 3078 | KM Mean                                                                                                                                  |   |   |   | 2180    |   | KM Standard Error of Mean                            |   |   |   | 236.3  |   |  |  |
| 3079 | KM SD                                                                                                                                    |   |   |   | 2874    |   | 95% KM (BCA) UCL                                     |   |   |   | 2636   |   |  |  |
| 3080 | 95% KM (t) UCL                                                                                                                           |   |   |   | 2571    |   | 95% KM (Percentile Bootstrap) UCL                    |   |   |   | 2586   |   |  |  |
| 3081 | 95% KM (z) UCL                                                                                                                           |   |   |   | 2568    |   | 95% KM Bootstrap t UCL                               |   |   |   | 2627   |   |  |  |
| 3082 | 90% KM Chebyshev UCL                                                                                                                     |   |   |   | 2889    |   | 95% KM Chebyshev UCL                                 |   |   |   | 3210   |   |  |  |

| A    | B | C                                                                                                                         | D         | E | F | G                                                            | H                           | I | J | K | L |
|------|---|---------------------------------------------------------------------------------------------------------------------------|-----------|---|---|--------------------------------------------------------------|-----------------------------|---|---|---|---|
| 3083 |   | 97.5% KM Chebyshev UCL                                                                                                    | 3655      |   |   | 99% KM Chebyshev UCL                                         | 4531                        |   |   |   |   |
| 3084 |   |                                                                                                                           |           |   |   |                                                              |                             |   |   |   |   |
| 3085 |   | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |           |   |   |                                                              |                             |   |   |   |   |
| 3086 |   | A-D Test Statistic                                                                                                        | 2.342     |   |   | <b>Anderson-Darling GOF Test</b>                             |                             |   |   |   |   |
| 3087 |   | 5% A-D Critical Value                                                                                                     | 0.792     |   |   | Detected Data Not Gamma Distributed at 5% Significance Level |                             |   |   |   |   |
| 3088 |   | K-S Test Statistic                                                                                                        | 0.131     |   |   | <b>Kolmogorov-Smirnov GOF</b>                                |                             |   |   |   |   |
| 3089 |   | 5% K-S Critical Value                                                                                                     | 0.0836    |   |   | Detected Data Not Gamma Distributed at 5% Significance Level |                             |   |   |   |   |
| 3090 |   | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                       |           |   |   |                                                              |                             |   |   |   |   |
| 3091 |   |                                                                                                                           |           |   |   |                                                              |                             |   |   |   |   |
| 3092 |   | <b>Gamma Statistics on Detected Data Only</b>                                                                             |           |   |   |                                                              |                             |   |   |   |   |
| 3093 |   | k hat (MLE)                                                                                                               | 0.819     |   |   | k star (bias corrected MLE)                                  | 0.805                       |   |   |   |   |
| 3094 |   | Theta hat (MLE)                                                                                                           | 2960      |   |   | Theta star (bias corrected MLE)                              | 3009                        |   |   |   |   |
| 3095 |   | nu hat (MLE)                                                                                                              | 219.4     |   |   | nu star (bias corrected)                                     | 215.8                       |   |   |   |   |
| 3096 |   | Mean (detects)                                                                                                            | 2423      |   |   |                                                              |                             |   |   |   |   |
| 3097 |   |                                                                                                                           |           |   |   |                                                              |                             |   |   |   |   |
| 3098 |   | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |           |   |   |                                                              |                             |   |   |   |   |
| 3099 |   | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |           |   |   |                                                              |                             |   |   |   |   |
| 3100 |   | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |           |   |   |                                                              |                             |   |   |   |   |
| 3101 |   | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |           |   |   |                                                              |                             |   |   |   |   |
| 3102 |   | This is especially true when the sample size is small.                                                                    |           |   |   |                                                              |                             |   |   |   |   |
| 3103 |   | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |           |   |   |                                                              |                             |   |   |   |   |
| 3104 |   | Minimum                                                                                                                   | 0.01      |   |   | Mean                                                         | 2179                        |   |   |   |   |
| 3105 |   | Maximum                                                                                                                   | 16900     |   |   | Median                                                       | 866                         |   |   |   |   |
| 3106 |   | SD                                                                                                                        | 2884      |   |   | CV                                                           | 1.323                       |   |   |   |   |
| 3107 |   | k hat (MLE)                                                                                                               | 0.372     |   |   | k star (bias corrected MLE)                                  | 0.369                       |   |   |   |   |
| 3108 |   | Theta hat (MLE)                                                                                                           | 5865      |   |   | Theta star (bias corrected MLE)                              | 5913                        |   |   |   |   |
| 3109 |   | nu hat (MLE)                                                                                                              | 110.7     |   |   | nu star (bias corrected)                                     | 109.8                       |   |   |   |   |
| 3110 |   | Adjusted Level of Significance ( $\beta$ )                                                                                | 0.0484    |   |   |                                                              |                             |   |   |   |   |
| 3111 |   | Approximate Chi Square Value (109.84, $\alpha$ )                                                                          | 86.65     |   |   | Adjusted Chi Square Value (109.84, $\beta$ )                 | 86.45                       |   |   |   |   |
| 3112 |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         | 2763      |   |   | 95% Gamma Adjusted UCL (use when $n < 50$ )                  | 2769                        |   |   |   |   |
| 3113 |   |                                                                                                                           |           |   |   |                                                              |                             |   |   |   |   |
| 3114 |   | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |           |   |   |                                                              |                             |   |   |   |   |
| 3115 |   | Mean (KM)                                                                                                                 | 2180      |   |   | SD (KM)                                                      | 2874                        |   |   |   |   |
| 3116 |   | Variance (KM)                                                                                                             | 8258049   |   |   | SE of Mean (KM)                                              | 236.3                       |   |   |   |   |
| 3117 |   | k hat (KM)                                                                                                                | 0.575     |   |   | k star (KM)                                                  | 0.568                       |   |   |   |   |
| 3118 |   | nu hat (KM)                                                                                                               | 171.4     |   |   | nu star (KM)                                                 | 169.3                       |   |   |   |   |
| 3119 |   | theta hat (KM)                                                                                                            | 3789      |   |   | theta star (KM)                                              | 3836                        |   |   |   |   |
| 3120 |   | 80% gamma percentile (KM)                                                                                                 | 3592      |   |   | 90% gamma percentile (KM)                                    | 5738                        |   |   |   |   |
| 3121 |   | 95% gamma percentile (KM)                                                                                                 | 7998      |   |   | 99% gamma percentile (KM)                                    | 13492                       |   |   |   |   |
| 3122 |   |                                                                                                                           |           |   |   |                                                              |                             |   |   |   |   |
| 3123 |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |           |   |   |                                                              |                             |   |   |   |   |
| 3124 |   | Approximate Chi Square Value (169.31, $\alpha$ )                                                                          | 140.2     |   |   | Adjusted Chi Square Value (169.31, $\beta$ )                 | 140                         |   |   |   |   |
| 3125 |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       | 2632      |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )               | 2637                        |   |   |   |   |
| 3126 |   |                                                                                                                           |           |   |   |                                                              |                             |   |   |   |   |
| 3127 |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |           |   |   |                                                              |                             |   |   |   |   |
| 3128 |   | Shapiro Wilk Approximate Test Statistic                                                                                   | 0.941     |   |   | <b>Shapiro Wilk GOF Test</b>                                 |                             |   |   |   |   |
| 3129 |   | 5% Shapiro Wilk P Value                                                                                                   | 1.0559E-5 |   |   | Detected Data Not Lognormal at 5% Significance Level         |                             |   |   |   |   |
| 3130 |   | Lilliefors Test Statistic                                                                                                 | 0.105     |   |   | <b>Lilliefors GOF Test</b>                                   |                             |   |   |   |   |
| 3131 |   | 5% Lilliefors Critical Value                                                                                              | 0.0769    |   |   | Detected Data Not Lognormal at 5% Significance Level         |                             |   |   |   |   |
| 3132 |   | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                               |           |   |   |                                                              |                             |   |   |   |   |
| 3133 |   |                                                                                                                           |           |   |   |                                                              |                             |   |   |   |   |
| 3134 |   | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |           |   |   |                                                              |                             |   |   |   |   |
| 3135 |   | Mean in Original Scale                                                                                                    | 2187      |   |   | Mean in Log Scale                                            | 6.777                       |   |   |   |   |
| 3136 |   | SD in Original Scale                                                                                                      | 2878      |   |   | SD in Log Scale                                              | 1.508                       |   |   |   |   |
| 3137 |   | 95% t UCL (assumes normality of ROS data)                                                                                 | 2577      |   |   | 95% Percentile Bootstrap UCL                                 | 2587                        |   |   |   |   |
| 3138 |   | 95% BCA Bootstrap UCL                                                                                                     | 2645      |   |   | 95% Bootstrap t UCL                                          | 2616                        |   |   |   |   |
| 3139 |   | 95% H-UCL (Log ROS)                                                                                                       | 3832      |   |   |                                                              |                             |   |   |   |   |
| 3140 |   |                                                                                                                           |           |   |   |                                                              |                             |   |   |   |   |
| 3141 |   | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |           |   |   |                                                              |                             |   |   |   |   |
| 3142 |   | KM Mean (logged)                                                                                                          | 6.433     |   |   | KM Geo Mean                                                  | 622.1                       |   |   |   |   |
| 3143 |   | KM SD (logged)                                                                                                            | 2.257     |   |   | 95% Critical H Value (KM-Log)                                | 3.61                        |   |   |   |   |
| 3144 |   | KM Standard Error of Mean (logged)                                                                                        | 0.186     |   |   | 95% H-UCL (KM -Log)                                          | 15520                       |   |   |   |   |
| 3145 |   | KM SD (logged)                                                                                                            | 2.257     |   |   | 95% Critical H Value (KM-Log)                                | 3.61                        |   |   |   |   |
| 3146 |   | KM Standard Error of Mean (logged)                                                                                        | 0.186     |   |   |                                                              |                             |   |   |   |   |
| 3147 |   |                                                                                                                           |           |   |   |                                                              |                             |   |   |   |   |
| 3148 |   | <b>DL/2 Statistics</b>                                                                                                    |           |   |   |                                                              |                             |   |   |   |   |
| 3149 |   | <b>DL/2 Normal</b>                                                                                                        |           |   |   |                                                              | <b>DL/2 Log-Transformed</b> |   |   |   |   |

| A    | B | C                                                                                                                                        | D      | E | F                                                            | G      | H | I | J | K | L |
|------|---|------------------------------------------------------------------------------------------------------------------------------------------|--------|---|--------------------------------------------------------------|--------|---|---|---|---|---|
| 3150 |   | Mean in Original Scale                                                                                                                   | 2184   |   | Mean in Log Scale                                            | 6.7    |   |   |   |   |   |
| 3151 |   | SD in Original Scale                                                                                                                     | 2880   |   | SD in Log Scale                                              | 1.698  |   |   |   |   |   |
| 3152 |   | 95% t UCL (Assumes normality)                                                                                                            | 2574   |   | 95% H-Stat UCL                                               | 5174   |   |   |   |   |   |
| 3153 |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |        |   |                                                              |        |   |   |   |   |   |
| 3154 |   |                                                                                                                                          |        |   |                                                              |        |   |   |   |   |   |
| 3155 |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |   |                                                              |        |   |   |   |   |   |
| 3156 |   | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                            |        |   |                                                              |        |   |   |   |   |   |
| 3157 |   |                                                                                                                                          |        |   |                                                              |        |   |   |   |   |   |
| 3158 |   | <b>Suggested UCL to Use</b>                                                                                                              |        |   |                                                              |        |   |   |   |   |   |
| 3159 |   | 95% KM (Chebyshev) UCL                                                                                                                   | 3210   |   |                                                              |        |   |   |   |   |   |
| 3160 |   |                                                                                                                                          |        |   |                                                              |        |   |   |   |   |   |
| 3161 |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |   |                                                              |        |   |   |   |   |   |
| 3162 |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |   |                                                              |        |   |   |   |   |   |
| 3163 |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |   |                                                              |        |   |   |   |   |   |
| 3164 |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |   |                                                              |        |   |   |   |   |   |
| 3165 |   |                                                                                                                                          |        |   |                                                              |        |   |   |   |   |   |
| 3166 |   | <b>Result (eu8_lead)</b>                                                                                                                 |        |   |                                                              |        |   |   |   |   |   |
| 3167 |   |                                                                                                                                          |        |   |                                                              |        |   |   |   |   |   |
| 3168 |   | <b>General Statistics</b>                                                                                                                |        |   |                                                              |        |   |   |   |   |   |
| 3169 |   | Total Number of Observations                                                                                                             | 149    |   | Number of Distinct Observations                              | 131    |   |   |   |   |   |
| 3170 |   | Number of Detects                                                                                                                        | 138    |   | Number of Non-Detects                                        | 11     |   |   |   |   |   |
| 3171 |   | Number of Distinct Detects                                                                                                               | 129    |   | Number of Distinct Non-Detects                               | 2      |   |   |   |   |   |
| 3172 |   | Minimum Detect                                                                                                                           | 0.59   |   | Minimum Non-Detect                                           | 0.03   |   |   |   |   |   |
| 3173 |   | Maximum Detect                                                                                                                           | 778    |   | Maximum Non-Detect                                           | 0.5    |   |   |   |   |   |
| 3174 |   | Variance Detects                                                                                                                         | 12152  |   | Percent Non-Detects                                          | 7.383% |   |   |   |   |   |
| 3175 |   | Mean Detects                                                                                                                             | 36.34  |   | SD Detects                                                   | 110.2  |   |   |   |   |   |
| 3176 |   | Median Detects                                                                                                                           | 8.69   |   | CV Detects                                                   | 3.034  |   |   |   |   |   |
| 3177 |   | Skewness Detects                                                                                                                         | 5.41   |   | Kurtosis Detects                                             | 31.05  |   |   |   |   |   |
| 3178 |   | Mean of Logged Detects                                                                                                                   | 2.27   |   | SD of Logged Detects                                         | 1.373  |   |   |   |   |   |
| 3179 |   |                                                                                                                                          |        |   |                                                              |        |   |   |   |   |   |
| 3180 |   | <b>Normal GOF Test on Detects Only</b>                                                                                                   |        |   |                                                              |        |   |   |   |   |   |
| 3181 |   | Shapiro Wilk Test Statistic                                                                                                              | 0.327  |   | <b>Normal GOF Test on Detected Observations Only</b>         |        |   |   |   |   |   |
| 3182 |   | 5% Shapiro Wilk P Value                                                                                                                  | 0      |   | Detected Data Not Normal at 5% Significance Level            |        |   |   |   |   |   |
| 3183 |   | Lilliefors Test Statistic                                                                                                                | 0.379  |   | <b>Lilliefors GOF Test</b>                                   |        |   |   |   |   |   |
| 3184 |   | 5% Lilliefors Critical Value                                                                                                             | 0.0758 |   | Detected Data Not Normal at 5% Significance Level            |        |   |   |   |   |   |
| 3185 |   | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |        |   |                                                              |        |   |   |   |   |   |
| 3186 |   |                                                                                                                                          |        |   |                                                              |        |   |   |   |   |   |
| 3187 |   | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |        |   |                                                              |        |   |   |   |   |   |
| 3188 |   | KM Mean                                                                                                                                  | 33.66  |   | KM Standard Error of Mean                                    | 8.726  |   |   |   |   |   |
| 3189 |   | KM SD                                                                                                                                    | 106.1  |   | 95% KM (BCA) UCL                                             | 48.81  |   |   |   |   |   |
| 3190 |   | 95% KM (t) UCL                                                                                                                           | 48.1   |   | 95% KM (Percentile Bootstrap) UCL                            | 48.5   |   |   |   |   |   |
| 3191 |   | 95% KM (z) UCL                                                                                                                           | 48.01  |   | 95% KM Bootstrap t UCL                                       | 58.66  |   |   |   |   |   |
| 3192 |   | 90% KM Chebyshev UCL                                                                                                                     | 59.84  |   | 95% KM Chebyshev UCL                                         | 71.69  |   |   |   |   |   |
| 3193 |   | 97.5% KM Chebyshev UCL                                                                                                                   | 88.15  |   | 99% KM Chebyshev UCL                                         | 120.5  |   |   |   |   |   |
| 3194 |   |                                                                                                                                          |        |   |                                                              |        |   |   |   |   |   |
| 3195 |   | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |        |   |                                                              |        |   |   |   |   |   |
| 3196 |   | A-D Test Statistic                                                                                                                       | 12.18  |   | <b>Anderson-Darling GOF Test</b>                             |        |   |   |   |   |   |
| 3197 |   | 5% A-D Critical Value                                                                                                                    | 0.824  |   | Detected Data Not Gamma Distributed at 5% Significance Level |        |   |   |   |   |   |
| 3198 |   | K-S Test Statistic                                                                                                                       | 0.238  |   | <b>Kolmogorov-Smirnov GOF</b>                                |        |   |   |   |   |   |
| 3199 |   | 5% K-S Critical Value                                                                                                                    | 0.0844 |   | Detected Data Not Gamma Distributed at 5% Significance Level |        |   |   |   |   |   |
| 3200 |   | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                                      |        |   |                                                              |        |   |   |   |   |   |
| 3201 |   |                                                                                                                                          |        |   |                                                              |        |   |   |   |   |   |
| 3202 |   | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |        |   |                                                              |        |   |   |   |   |   |
| 3203 |   | k hat (MLE)                                                                                                                              | 0.483  |   | k star (bias corrected MLE)                                  | 0.477  |   |   |   |   |   |
| 3204 |   | Theta hat (MLE)                                                                                                                          | 75.28  |   | Theta star (bias corrected MLE)                              | 76.18  |   |   |   |   |   |
| 3205 |   | nu hat (MLE)                                                                                                                             | 133.2  |   | nu star (bias corrected)                                     | 131.7  |   |   |   |   |   |
| 3206 |   | Mean (detects)                                                                                                                           | 36.34  |   |                                                              |        |   |   |   |   |   |
| 3207 |   |                                                                                                                                          |        |   |                                                              |        |   |   |   |   |   |
| 3208 |   | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |        |   |                                                              |        |   |   |   |   |   |
| 3209 |   | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |        |   |                                                              |        |   |   |   |   |   |
| 3210 |   | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |        |   |                                                              |        |   |   |   |   |   |
| 3211 |   | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |        |   |                                                              |        |   |   |   |   |   |
| 3212 |   | This is especially true when the sample size is small.                                                                                   |        |   |                                                              |        |   |   |   |   |   |
| 3213 |   | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |        |   |                                                              |        |   |   |   |   |   |
| 3214 |   | Minimum                                                                                                                                  | 0.01   |   | Mean                                                         | 33.66  |   |   |   |   |   |
| 3215 |   | Maximum                                                                                                                                  | 778    |   | Median                                                       | 7.55   |   |   |   |   |   |
| 3216 |   | SD                                                                                                                                       | 106.5  |   | CV                                                           | 3.164  |   |   |   |   |   |

| A    | B | C | D | E                                                                                                                                        | F         | G | H | I                           | J                                                    | K | L     |
|------|---|---|---|------------------------------------------------------------------------------------------------------------------------------------------|-----------|---|---|-----------------------------|------------------------------------------------------|---|-------|
| 3217 |   |   |   | k hat (MLE)                                                                                                                              | 0.379     |   |   |                             | k star (bias corrected MLE)                          |   | 0.375 |
| 3218 |   |   |   | Theta hat (MLE)                                                                                                                          | 88.91     |   |   |                             | Theta star (bias corrected MLE)                      |   | 89.66 |
| 3219 |   |   |   | nu hat (MLE)                                                                                                                             | 112.8     |   |   |                             | nu star (bias corrected)                             |   | 111.9 |
| 3220 |   |   |   | Adjusted Level of Significance ( $\beta$ )                                                                                               | 0.0484    |   |   |                             |                                                      |   |       |
| 3221 |   |   |   | Approximate Chi Square Value (111.86, $\alpha$ )                                                                                         | 88.45     |   |   |                             | Adjusted Chi Square Value (111.86, $\beta$ )         |   | 88.24 |
| 3222 |   |   |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                                        | 42.57     |   |   |                             | 95% Gamma Adjusted UCL (use when $n < 50$ )          |   | 42.66 |
| 3223 |   |   |   | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |           |   |   |                             |                                                      |   |       |
| 3224 |   |   |   | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |           |   |   |                             |                                                      |   |       |
| 3225 |   |   |   | Mean (KM)                                                                                                                                | 33.66     |   |   |                             | SD (KM)                                              |   | 106.1 |
| 3226 |   |   |   | Variance (KM)                                                                                                                            | 11264     |   |   |                             | SE of Mean (KM)                                      |   | 8.726 |
| 3227 |   |   |   | k hat (KM)                                                                                                                               | 0.101     |   |   |                             | k star (KM)                                          |   | 0.103 |
| 3228 |   |   |   | nu hat (KM)                                                                                                                              | 29.97     |   |   |                             | nu star (KM)                                         |   | 30.7  |
| 3229 |   |   |   | theta hat (KM)                                                                                                                           | 334.7     |   |   |                             | theta star (KM)                                      |   | 326.7 |
| 3230 |   |   |   | 80% gamma percentile (KM)                                                                                                                | 24.36     |   |   |                             | 90% gamma percentile (KM)                            |   | 90.66 |
| 3231 |   |   |   | 95% gamma percentile (KM)                                                                                                                | 195       |   |   |                             | 99% gamma percentile (KM)                            |   | 526.7 |
| 3232 |   |   |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |           |   |   |                             |                                                      |   |       |
| 3233 |   |   |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |           |   |   |                             |                                                      |   |       |
| 3234 |   |   |   | Approximate Chi Square Value (30.70, $\alpha$ )                                                                                          | 19.04     |   |   |                             | Adjusted Chi Square Value (30.70, $\beta$ )          |   | 18.95 |
| 3235 |   |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                      | 54.26     |   |   |                             | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )       |   | 54.51 |
| 3236 |   |   |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |           |   |   |                             |                                                      |   |       |
| 3237 |   |   |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |           |   |   |                             |                                                      |   |       |
| 3238 |   |   |   | Shapiro Wilk Approximate Test Statistic                                                                                                  | 0.943     |   |   |                             | <b>Shapiro Wilk GOF Test</b>                         |   |       |
| 3239 |   |   |   | 5% Shapiro Wilk P Value                                                                                                                  | 1.3836E-5 |   |   |                             | Detected Data Not Lognormal at 5% Significance Level |   |       |
| 3240 |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.0918    |   |   |                             | <b>Lilliefors GOF Test</b>                           |   |       |
| 3241 |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.0758    |   |   |                             | Detected Data Not Lognormal at 5% Significance Level |   |       |
| 3242 |   |   |   | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                                              |           |   |   |                             |                                                      |   |       |
| 3243 |   |   |   | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                                              |           |   |   |                             |                                                      |   |       |
| 3244 |   |   |   | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |           |   |   |                             |                                                      |   |       |
| 3245 |   |   |   | Mean in Original Scale                                                                                                                   | 33.69     |   |   |                             | Mean in Log Scale                                    |   | 2.037 |
| 3246 |   |   |   | SD in Original Scale                                                                                                                     | 106.5     |   |   |                             | SD in Log Scale                                      |   | 1.562 |
| 3247 |   |   |   | 95% t UCL (assumes normality of ROS data)                                                                                                | 48.13     |   |   |                             | 95% Percentile Bootstrap UCL                         |   | 48.39 |
| 3248 |   |   |   | 95% BCA Bootstrap UCL                                                                                                                    | 54.18     |   |   |                             | 95% Bootstrap t UCL                                  |   | 57.46 |
| 3249 |   |   |   | 95% H-UCL (Log ROS)                                                                                                                      | 37.14     |   |   |                             |                                                      |   |       |
| 3250 |   |   |   | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |           |   |   |                             |                                                      |   |       |
| 3251 |   |   |   | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |           |   |   |                             |                                                      |   |       |
| 3252 |   |   |   | KM Mean (logged)                                                                                                                         | 1.843     |   |   |                             | KM Geo Mean                                          |   | 6.317 |
| 3253 |   |   |   | KM SD (logged)                                                                                                                           | 2.003     |   |   |                             | 95% Critical H Value (KM-Log)                        |   | 3.298 |
| 3254 |   |   |   | KM Standard Error of Mean (logged)                                                                                                       | 0.165     |   |   |                             | 95% H-UCL (KM -Log)                                  |   | 80.89 |
| 3255 |   |   |   | KM SD (logged)                                                                                                                           | 2.003     |   |   |                             | 95% Critical H Value (KM-Log)                        |   | 3.298 |
| 3256 |   |   |   | KM Standard Error of Mean (logged)                                                                                                       | 0.165     |   |   |                             |                                                      |   |       |
| 3257 |   |   |   | <b>DL/2 Statistics</b>                                                                                                                   |           |   |   |                             |                                                      |   |       |
| 3258 |   |   |   | <b>DL/2 Statistics</b>                                                                                                                   |           |   |   |                             |                                                      |   |       |
| 3259 |   |   |   | <b>DL/2 Normal</b>                                                                                                                       |           |   |   | <b>DL/2 Log-Transformed</b> |                                                      |   |       |
| 3260 |   |   |   | Mean in Original Scale                                                                                                                   | 33.67     |   |   |                             | Mean in Log Scale                                    |   | 1.962 |
| 3261 |   |   |   | SD in Original Scale                                                                                                                     | 106.5     |   |   |                             | SD in Log Scale                                      |   | 1.74  |
| 3262 |   |   |   | 95% t UCL (Assumes normality)                                                                                                            | 48.11     |   |   |                             | 95% H-Stat UCL                                       |   | 49.51 |
| 3263 |   |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |           |   |   |                             |                                                      |   |       |
| 3264 |   |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |           |   |   |                             |                                                      |   |       |
| 3265 |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |           |   |   |                             |                                                      |   |       |
| 3266 |   |   |   | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                            |           |   |   |                             |                                                      |   |       |
| 3267 |   |   |   | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                            |           |   |   |                             |                                                      |   |       |
| 3268 |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |           |   |   |                             |                                                      |   |       |
| 3269 |   |   |   | 95% KM (Chebyshev) UCL                                                                                                                   | 71.69     |   |   |                             |                                                      |   |       |
| 3270 |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |           |   |   |                             |                                                      |   |       |
| 3271 |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |           |   |   |                             |                                                      |   |       |
| 3272 |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |           |   |   |                             |                                                      |   |       |
| 3273 |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |           |   |   |                             |                                                      |   |       |
| 3274 |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |           |   |   |                             |                                                      |   |       |
| 3275 |   |   |   | <b>Result (eu8_manganese)</b>                                                                                                            |           |   |   |                             |                                                      |   |       |
| 3276 |   |   |   | <b>Result (eu8_manganese)</b>                                                                                                            |           |   |   |                             |                                                      |   |       |
| 3277 |   |   |   | <b>Result (eu8_manganese)</b>                                                                                                            |           |   |   |                             |                                                      |   |       |
| 3278 |   |   |   | <b>General Statistics</b>                                                                                                                |           |   |   |                             |                                                      |   |       |
| 3279 |   |   |   | Total Number of Observations                                                                                                             | 149       |   |   |                             | Number of Distinct Observations                      |   | 130   |
| 3280 |   |   |   | Number of Detects                                                                                                                        | 147       |   |   |                             | Number of Non-Detects                                |   | 2     |
| 3281 |   |   |   | Number of Distinct Detects                                                                                                               | 129       |   |   |                             | Number of Distinct Non-Detects                       |   | 1     |
| 3282 |   |   |   | Minimum Detect                                                                                                                           | 6.95      |   |   |                             | Minimum Non-Detect                                   |   | 2     |
| 3283 |   |   |   | Maximum Detect                                                                                                                           | 3610      |   |   |                             | Maximum Non-Detect                                   |   | 2     |

|      | A                                                                                                                         | B | C | D                                                   | E       | F | G                                                            | H | I | J                                              | K | L      |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|-----------------------------------------------------|---------|---|--------------------------------------------------------------|---|---|------------------------------------------------|---|--------|
| 3284 |                                                                                                                           |   |   | Variance Detects                                    | 371885  |   |                                                              |   |   | Percent Non-Detects                            |   | 1.3429 |
| 3285 |                                                                                                                           |   |   | Mean Detects                                        | 408.5   |   |                                                              |   |   | SD Detects                                     |   | 609.8  |
| 3286 |                                                                                                                           |   |   | Median Detects                                      | 228     |   |                                                              |   |   | CV Detects                                     |   | 1.493  |
| 3287 |                                                                                                                           |   |   | Skewness Detects                                    | 3.461   |   |                                                              |   |   | Kurtosis Detects                               |   | 12.59  |
| 3288 |                                                                                                                           |   |   | Mean of Logged Detects                              | 5.427   |   |                                                              |   |   | SD of Logged Detects                           |   | 1.059  |
| 3289 |                                                                                                                           |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3290 | <b>Normal GOF Test on Detects Only</b>                                                                                    |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3291 |                                                                                                                           |   |   | Shapiro Wilk Test Statistic                         | 0.547   |   | <b>Normal GOF Test on Detected Observations Only</b>         |   |   |                                                |   |        |
| 3292 |                                                                                                                           |   |   | 5% Shapiro Wilk P Value                             | 0       |   | Detected Data Not Normal at 5% Significance Level            |   |   |                                                |   |        |
| 3293 |                                                                                                                           |   |   | Lilliefors Test Statistic                           | 0.285   |   | <b>Lilliefors GOF Test</b>                                   |   |   |                                                |   |        |
| 3294 |                                                                                                                           |   |   | 5% Lilliefors Critical Value                        | 0.0735  |   | Detected Data Not Normal at 5% Significance Level            |   |   |                                                |   |        |
| 3295 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                  |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3296 |                                                                                                                           |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3297 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3298 |                                                                                                                           |   |   | KM Mean                                             | 403.1   |   |                                                              |   |   | KM Standard Error of Mean                      |   | 49.77  |
| 3299 |                                                                                                                           |   |   | KM SD                                               | 605.5   |   |                                                              |   |   | 95% KM (BCA) UCL                               |   | 494.6  |
| 3300 |                                                                                                                           |   |   | 95% KM (t) UCL                                      | 485.5   |   |                                                              |   |   | 95% KM (Percentile Bootstrap) UCL              |   | 482.5  |
| 3301 |                                                                                                                           |   |   | 95% KM (z) UCL                                      | 484.9   |   |                                                              |   |   | 95% KM Bootstrap t UCL                         |   | 510.6  |
| 3302 |                                                                                                                           |   |   | 90% KM Chebyshev UCL                                | 552.4   |   |                                                              |   |   | 95% KM Chebyshev UCL                           |   | 620    |
| 3303 |                                                                                                                           |   |   | 97.5% KM Chebyshev UCL                              | 713.9   |   |                                                              |   |   | 99% KM Chebyshev UCL                           |   | 898.3  |
| 3304 |                                                                                                                           |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3305 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3306 |                                                                                                                           |   |   | A-D Test Statistic                                  | 5.545   |   | <b>Anderson-Darling GOF Test</b>                             |   |   |                                                |   |        |
| 3307 |                                                                                                                           |   |   | 5% A-D Critical Value                               | 0.784   |   | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |                                                |   |        |
| 3308 |                                                                                                                           |   |   | K-S Test Statistic                                  | 0.15    |   | <b>Kolmogorov-Smirnov GOF</b>                                |   |   |                                                |   |        |
| 3309 |                                                                                                                           |   |   | 5% K-S Critical Value                               | 0.0797  |   | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |                                                |   |        |
| 3310 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                       |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3311 |                                                                                                                           |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3312 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3313 |                                                                                                                           |   |   | k hat (MLE)                                         | 0.987   |   |                                                              |   |   | k star (bias corrected MLE)                    |   | 0.971  |
| 3314 |                                                                                                                           |   |   | Theta hat (MLE)                                     | 414     |   |                                                              |   |   | Theta star (bias corrected MLE)                |   | 420.6  |
| 3315 |                                                                                                                           |   |   | nu hat (MLE)                                        | 290.1   |   |                                                              |   |   | nu star (bias corrected)                       |   | 285.5  |
| 3316 |                                                                                                                           |   |   | Mean (detects)                                      | 408.5   |   |                                                              |   |   |                                                |   |        |
| 3317 |                                                                                                                           |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3318 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3319 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3320 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3321 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3322 | This is especially true when the sample size is small.                                                                    |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3323 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3324 |                                                                                                                           |   |   | Minimum                                             | 0.01    |   |                                                              |   |   | Mean                                           |   | 403    |
| 3325 |                                                                                                                           |   |   | Maximum                                             | 3610    |   |                                                              |   |   | Median                                         |   | 223    |
| 3326 |                                                                                                                           |   |   | SD                                                  | 607.5   |   |                                                              |   |   | CV                                             |   | 1.507  |
| 3327 |                                                                                                                           |   |   | k hat (MLE)                                         | 0.835   |   |                                                              |   |   | k star (bias corrected MLE)                    |   | 0.823  |
| 3328 |                                                                                                                           |   |   | Theta hat (MLE)                                     | 482.8   |   |                                                              |   |   | Theta star (bias corrected MLE)                |   | 490    |
| 3329 |                                                                                                                           |   |   | nu hat (MLE)                                        | 248.8   |   |                                                              |   |   | nu star (bias corrected)                       |   | 245.1  |
| 3330 |                                                                                                                           |   |   | Adjusted Level of Significance ( $\beta$ )          | 0.0484  |   |                                                              |   |   |                                                |   |        |
| 3331 |                                                                                                                           |   |   | Approximate Chi Square Value (245.11, $\alpha$ )    | 209.9   |   |                                                              |   |   | Adjusted Chi Square Value (245.11, $\beta$ )   |   | 209.5  |
| 3332 |                                                                                                                           |   |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )   | 470.7   |   |                                                              |   |   | 95% Gamma Adjusted UCL (use when $n < 50$ )    |   | 471.4  |
| 3333 |                                                                                                                           |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3334 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3335 |                                                                                                                           |   |   | Mean (KM)                                           | 403.1   |   |                                                              |   |   | SD (KM)                                        |   | 605.5  |
| 3336 |                                                                                                                           |   |   | Variance (KM)                                       | 366586  |   |                                                              |   |   | SE of Mean (KM)                                |   | 49.77  |
| 3337 |                                                                                                                           |   |   | k hat (KM)                                          | 0.443   |   |                                                              |   |   | k star (KM)                                    |   | 0.439  |
| 3338 |                                                                                                                           |   |   | nu hat (KM)                                         | 132.1   |   |                                                              |   |   | nu star (KM)                                   |   | 130.7  |
| 3339 |                                                                                                                           |   |   | theta hat (KM)                                      | 909.5   |   |                                                              |   |   | theta star (KM)                                |   | 918.7  |
| 3340 |                                                                                                                           |   |   | 80% gamma percentile (KM)                           | 656.6   |   |                                                              |   |   | 90% gamma percentile (KM)                      |   | 1119   |
| 3341 |                                                                                                                           |   |   | 95% gamma percentile (KM)                           | 1622    |   |                                                              |   |   | 99% gamma percentile (KM)                      |   | 2873   |
| 3342 |                                                                                                                           |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3343 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3344 |                                                                                                                           |   |   | Approximate Chi Square Value (130.74, $\alpha$ )    | 105.3   |   |                                                              |   |   | Adjusted Chi Square Value (130.74, $\beta$ )   |   | 105.1  |
| 3345 |                                                                                                                           |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ ) | 500.3   |   |                                                              |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ ) |   | 501.4  |
| 3346 |                                                                                                                           |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3347 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |                                                     |         |   |                                                              |   |   |                                                |   |        |
| 3348 |                                                                                                                           |   |   | Shapiro Wilk Approximate Test Statistic             | 0.959   |   | <b>Shapiro Wilk GOF Test</b>                                 |   |   |                                                |   |        |
| 3349 |                                                                                                                           |   |   | 5% Shapiro Wilk P Value                             | 0.00268 |   | Detected Data Not Lognormal at 5% Significance Level         |   |   |                                                |   |        |
| 3350 |                                                                                                                           |   |   | Lilliefors Test Statistic                           | 0.0913  |   | <b>Lilliefors GOF Test</b>                                   |   |   |                                                |   |        |

| A    | B                                                                                                                                        | C | D         | E                                                    | F | G                                       | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|-----------|------------------------------------------------------|---|-----------------------------------------|---|---|---|---|---|
| 3351 | 5% Lilliefors Critical Value                                                                                                             |   | 0.0735    | Detected Data Not Lognormal at 5% Significance Level |   |                                         |   |   |   |   |   |
| 3352 | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                                              |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3353 |                                                                                                                                          |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3354 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3355 | Mean in Original Scale                                                                                                                   |   | 403.2     | Mean in Log Scale                                    |   | 5.39                                    |   |   |   |   |   |
| 3356 | SD in Original Scale                                                                                                                     |   | 607.4     | SD in Log Scale                                      |   | 1.1                                     |   |   |   |   |   |
| 3357 | 95% t UCL (assumes normality of ROS data)                                                                                                |   | 485.6     | 95% Percentile Bootstrap UCL                         |   | 490.2                                   |   |   |   |   |   |
| 3358 | 95% BCA Bootstrap UCL                                                                                                                    |   | 503.4     | 95% Bootstrap t UCL                                  |   | 510.9                                   |   |   |   |   |   |
| 3359 | 95% H-UCL (Log ROS)                                                                                                                      |   | 493.6     |                                                      |   |                                         |   |   |   |   |   |
| 3360 |                                                                                                                                          |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3361 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3362 | KM Mean (logged)                                                                                                                         |   | 5.363     | KM Geo Mean                                          |   | 213.4                                   |   |   |   |   |   |
| 3363 | KM SD (logged)                                                                                                                           |   | 1.182     | 95% Critical H Value (KM-Log)                        |   | 2.376                                   |   |   |   |   |   |
| 3364 | KM Standard Error of Mean (logged)                                                                                                       |   | 0.0971    | 95% H-UCL (KM -Log)                                  |   | 540.2                                   |   |   |   |   |   |
| 3365 | KM SD (logged)                                                                                                                           |   | 1.182     | 95% Critical H Value (KM-Log)                        |   | 2.376                                   |   |   |   |   |   |
| 3366 | KM Standard Error of Mean (logged)                                                                                                       |   | 0.0971    |                                                      |   |                                         |   |   |   |   |   |
| 3367 |                                                                                                                                          |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3368 | <b>DL/2 Statistics</b>                                                                                                                   |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3369 | <b>DL/2 Normal</b>                                                                                                                       |   |           |                                                      |   | <b>DL/2 Log-Transformed</b>             |   |   |   |   |   |
| 3370 | Mean in Original Scale                                                                                                                   |   | 403.1     | Mean in Log Scale                                    |   | 5.354                                   |   |   |   |   |   |
| 3371 | SD in Original Scale                                                                                                                     |   | 607.5     | SD in Log Scale                                      |   | 1.225                                   |   |   |   |   |   |
| 3372 | 95% t UCL (Assumes normality)                                                                                                            |   | 485.4     | 95% H-Stat UCL                                       |   | 570.8                                   |   |   |   |   |   |
| 3373 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3374 |                                                                                                                                          |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3375 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3376 | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                            |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3377 |                                                                                                                                          |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3378 | <b>Suggested UCL to Use</b>                                                                                                              |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3379 | 95% KM (Chebyshev) UCL                                                                                                                   |   | 620       |                                                      |   |                                         |   |   |   |   |   |
| 3380 |                                                                                                                                          |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3381 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3382 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3383 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3384 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3385 |                                                                                                                                          |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3386 |                                                                                                                                          |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3387 | <b>Result (eu8_strontium)</b>                                                                                                            |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3388 |                                                                                                                                          |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3389 | <b>General Statistics</b>                                                                                                                |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3390 | Total Number of Observations                                                                                                             |   | 99        | Number of Distinct Observations                      |   | 92                                      |   |   |   |   |   |
| 3391 |                                                                                                                                          |   |           | Number of Missing Observations                       |   | 0                                       |   |   |   |   |   |
| 3392 | Minimum                                                                                                                                  |   | 140       | Mean                                                 |   | 527.3                                   |   |   |   |   |   |
| 3393 | Maximum                                                                                                                                  |   | 1780      | Median                                               |   | 448                                     |   |   |   |   |   |
| 3394 | SD                                                                                                                                       |   | 355.6     | Std. Error of Mean                                   |   | 35.73                                   |   |   |   |   |   |
| 3395 | Coefficient of Variation                                                                                                                 |   | 0.674     | Skewness                                             |   | 0.998                                   |   |   |   |   |   |
| 3396 |                                                                                                                                          |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3397 | <b>Normal GOF Test</b>                                                                                                                   |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3398 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.878     | <b>Shapiro Wilk GOF Test</b>                         |   |                                         |   |   |   |   |   |
| 3399 | 5% Shapiro Wilk P Value                                                                                                                  |   | 2.384E-11 | Data Not Normal at 5% Significance Level             |   |                                         |   |   |   |   |   |
| 3400 | Lilliefors Test Statistic                                                                                                                |   | 0.179     | <b>Lilliefors GOF Test</b>                           |   |                                         |   |   |   |   |   |
| 3401 | 5% Lilliefors Critical Value                                                                                                             |   | 0.0893    | Data Not Normal at 5% Significance Level             |   |                                         |   |   |   |   |   |
| 3402 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3403 |                                                                                                                                          |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3404 | <b>Assuming Normal Distribution</b>                                                                                                      |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3405 | <b>95% Normal UCL</b>                                                                                                                    |   |           |                                                      |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |   |   |   |   |
| 3406 | 95% Student's-t UCL                                                                                                                      |   | 586.6     | 95% Adjusted-CLT UCL (Chen-1995)                     |   | 589.9                                   |   |   |   |   |   |
| 3407 |                                                                                                                                          |   |           | 95% Modified-t UCL (Johnson-1978)                    |   | 587.2                                   |   |   |   |   |   |
| 3408 |                                                                                                                                          |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3409 | <b>Gamma GOF Test</b>                                                                                                                    |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3410 | A-D Test Statistic                                                                                                                       |   | 2.472     | <b>Anderson-Darling Gamma GOF Test</b>               |   |                                         |   |   |   |   |   |
| 3411 | 5% A-D Critical Value                                                                                                                    |   | 0.763     | Data Not Gamma Distributed at 5% Significance Level  |   |                                         |   |   |   |   |   |
| 3412 | K-S Test Statistic                                                                                                                       |   | 0.168     | <b>Kolmogorov-Smirnov Gamma GOF Test</b>             |   |                                         |   |   |   |   |   |
| 3413 | 5% K-S Critical Value                                                                                                                    |   | 0.0909    | Data Not Gamma Distributed at 5% Significance Level  |   |                                         |   |   |   |   |   |
| 3414 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3415 |                                                                                                                                          |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3416 | <b>Gamma Statistics</b>                                                                                                                  |   |           |                                                      |   |                                         |   |   |   |   |   |
| 3417 | k hat (MLE)                                                                                                                              |   | 2.324     | k star (bias corrected MLE)                          |   | 2.26                                    |   |   |   |   |   |

| A    | B | C | D                                                                                                                                        | E | F         | G | H | I                                                    | J | K | L      |
|------|---|---|------------------------------------------------------------------------------------------------------------------------------------------|---|-----------|---|---|------------------------------------------------------|---|---|--------|
| 3418 |   |   | Theta hat (MLE)                                                                                                                          |   | 226.9     |   |   | Theta star (bias corrected MLE)                      |   |   | 233.3  |
| 3419 |   |   | nu hat (MLE)                                                                                                                             |   | 460.1     |   |   | nu star (bias corrected)                             |   |   | 447.5  |
| 3420 |   |   | MLE Mean (bias corrected)                                                                                                                |   | 527.3     |   |   | MLE Sd (bias corrected)                              |   |   | 350.7  |
| 3421 |   |   |                                                                                                                                          |   |           |   |   | Approximate Chi Square Value (0.05)                  |   |   | 399.5  |
| 3422 |   |   | Adjusted Level of Significance                                                                                                           |   | 0.0476    |   |   | Adjusted Chi Square Value                            |   |   | 398.8  |
| 3423 |   |   |                                                                                                                                          |   |           |   |   |                                                      |   |   |        |
| 3424 |   |   | <b>Assuming Gamma Distribution</b>                                                                                                       |   |           |   |   |                                                      |   |   |        |
| 3425 |   |   | 95% Approximate Gamma UCL (use when n>=50))                                                                                              |   | 590.7     |   |   | 95% Adjusted Gamma UCL (use when n<50)               |   |   | 591.7  |
| 3426 |   |   |                                                                                                                                          |   |           |   |   |                                                      |   |   |        |
| 3427 |   |   | <b>Lognormal GOF Test</b>                                                                                                                |   |           |   |   |                                                      |   |   |        |
| 3428 |   |   | Shapiro Wilk Test Statistic                                                                                                              |   | 0.915     |   |   | <b>Shapiro Wilk Lognormal GOF Test</b>               |   |   |        |
| 3429 |   |   | 5% Shapiro Wilk P Value                                                                                                                  |   | 4.4513E-7 |   |   | Data Not Lognormal at 5% Significance Level          |   |   |        |
| 3430 |   |   | Lilliefors Test Statistic                                                                                                                |   | 0.15      |   |   | <b>Lilliefors Lognormal GOF Test</b>                 |   |   |        |
| 3431 |   |   | 5% Lilliefors Critical Value                                                                                                             |   | 0.0893    |   |   | Data Not Lognormal at 5% Significance Level          |   |   |        |
| 3432 |   |   | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |   |           |   |   |                                                      |   |   |        |
| 3433 |   |   |                                                                                                                                          |   |           |   |   |                                                      |   |   |        |
| 3434 |   |   | <b>Lognormal Statistics</b>                                                                                                              |   |           |   |   |                                                      |   |   |        |
| 3435 |   |   | Minimum of Logged Data                                                                                                                   |   | 4.942     |   |   | Mean of logged Data                                  |   |   | 6.037  |
| 3436 |   |   | Maximum of Logged Data                                                                                                                   |   | 7.484     |   |   | SD of logged Data                                    |   |   | 0.695  |
| 3437 |   |   |                                                                                                                                          |   |           |   |   |                                                      |   |   |        |
| 3438 |   |   | <b>Assuming Lognormal Distribution</b>                                                                                                   |   |           |   |   |                                                      |   |   |        |
| 3439 |   |   | 95% H-UCL                                                                                                                                |   | 614.4     |   |   | 90% Chebyshev (MVUE) UCL                             |   |   | 654.3  |
| 3440 |   |   | 95% Chebyshev (MVUE) UCL                                                                                                                 |   | 709.9     |   |   | 97.5% Chebyshev (MVUE) UCL                           |   |   | 787.1  |
| 3441 |   |   | 99% Chebyshev (MVUE) UCL                                                                                                                 |   | 938.7     |   |   |                                                      |   |   |        |
| 3442 |   |   |                                                                                                                                          |   |           |   |   |                                                      |   |   |        |
| 3443 |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |           |   |   |                                                      |   |   |        |
| 3444 |   |   | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |   |           |   |   |                                                      |   |   |        |
| 3445 |   |   |                                                                                                                                          |   |           |   |   |                                                      |   |   |        |
| 3446 |   |   | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |   |           |   |   |                                                      |   |   |        |
| 3447 |   |   | 95% CLT UCL                                                                                                                              |   | 586       |   |   | 95% Jackknife UCL                                    |   |   | 586.6  |
| 3448 |   |   | 95% Standard Bootstrap UCL                                                                                                               |   | 585.5     |   |   | 95% Bootstrap-t UCL                                  |   |   | 592.4  |
| 3449 |   |   | 95% Hall's Bootstrap UCL                                                                                                                 |   | 591       |   |   | 95% Percentile Bootstrap UCL                         |   |   | 587.3  |
| 3450 |   |   | 95% BCA Bootstrap UCL                                                                                                                    |   | 589.2     |   |   |                                                      |   |   |        |
| 3451 |   |   | 90% Chebyshev(Mean, Sd) UCL                                                                                                              |   | 634.5     |   |   | 95% Chebyshev(Mean, Sd) UCL                          |   |   | 683    |
| 3452 |   |   | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                            |   | 750.4     |   |   | 99% Chebyshev(Mean, Sd) UCL                          |   |   | 882.8  |
| 3453 |   |   |                                                                                                                                          |   |           |   |   |                                                      |   |   |        |
| 3454 |   |   | <b>Suggested UCL to Use</b>                                                                                                              |   |           |   |   |                                                      |   |   |        |
| 3455 |   |   | 95% Chebyshev (Mean, Sd) UCL                                                                                                             |   | 683       |   |   |                                                      |   |   |        |
| 3456 |   |   |                                                                                                                                          |   |           |   |   |                                                      |   |   |        |
| 3457 |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |           |   |   |                                                      |   |   |        |
| 3458 |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |           |   |   |                                                      |   |   |        |
| 3459 |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |           |   |   |                                                      |   |   |        |
| 3460 |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |           |   |   |                                                      |   |   |        |
| 3461 |   |   |                                                                                                                                          |   |           |   |   |                                                      |   |   |        |
| 3462 |   |   | <b>Result (eu8_thallium)</b>                                                                                                             |   |           |   |   |                                                      |   |   |        |
| 3463 |   |   |                                                                                                                                          |   |           |   |   |                                                      |   |   |        |
| 3464 |   |   | <b>General Statistics</b>                                                                                                                |   |           |   |   |                                                      |   |   |        |
| 3465 |   |   | Total Number of Observations                                                                                                             |   | 149       |   |   | Number of Distinct Observations                      |   |   | 12     |
| 3466 |   |   | Number of Detects                                                                                                                        |   | 9         |   |   | Number of Non-Detects                                |   |   | 140    |
| 3467 |   |   | Number of Distinct Detects                                                                                                               |   | 9         |   |   | Number of Distinct Non-Detects                       |   |   | 3      |
| 3468 |   |   | Minimum Detect                                                                                                                           |   | 5.85      |   |   | Minimum Non-Detect                                   |   |   | 0.031  |
| 3469 |   |   | Maximum Detect                                                                                                                           |   | 12.8      |   |   | Maximum Non-Detect                                   |   |   | 5      |
| 3470 |   |   | Variance Detects                                                                                                                         |   | 5.739     |   |   | Percent Non-Detects                                  |   |   | 93.96% |
| 3471 |   |   | Mean Detects                                                                                                                             |   | 9.218     |   |   | SD Detects                                           |   |   | 2.396  |
| 3472 |   |   | Median Detects                                                                                                                           |   | 8.75      |   |   | CV Detects                                           |   |   | 0.26   |
| 3473 |   |   | Skewness Detects                                                                                                                         |   | 0.156     |   |   | Kurtosis Detects                                     |   |   | -0.98  |
| 3474 |   |   | Mean of Logged Detects                                                                                                                   |   | 2.19      |   |   | SD of Logged Detects                                 |   |   | 0.268  |
| 3475 |   |   |                                                                                                                                          |   |           |   |   |                                                      |   |   |        |
| 3476 |   |   | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |           |   |   |                                                      |   |   |        |
| 3477 |   |   | Shapiro Wilk Test Statistic                                                                                                              |   | 0.961     |   |   | <b>Shapiro Wilk GOF Test</b>                         |   |   |        |
| 3478 |   |   | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.829     |   |   | Detected Data appear Normal at 5% Significance Level |   |   |        |
| 3479 |   |   | Lilliefors Test Statistic                                                                                                                |   | 0.133     |   |   | <b>Lilliefors GOF Test</b>                           |   |   |        |
| 3480 |   |   | 5% Lilliefors Critical Value                                                                                                             |   | 0.274     |   |   | Detected Data appear Normal at 5% Significance Level |   |   |        |
| 3481 |   |   | <b>Detected Data appear Normal at 5% Significance Level</b>                                                                              |   |           |   |   |                                                      |   |   |        |
| 3482 |   |   |                                                                                                                                          |   |           |   |   |                                                      |   |   |        |
| 3483 |   |   | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |           |   |   |                                                      |   |   |        |
| 3484 |   |   | KM Mean                                                                                                                                  |   | 0.586     |   |   | KM Standard Error of Mean                            |   |   | 0.196  |

|      | A                                                                                                                         | B | C | D | E                                                   | F      | G                                                             | H | I | J | K                                              | L      |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|---|-----------------------------------------------------|--------|---------------------------------------------------------------|---|---|---|------------------------------------------------|--------|
| 3485 |                                                                                                                           |   |   |   | KM SD                                               | 2.258  |                                                               |   |   |   | 95% KM (BCA) UCL                               | 0.958  |
| 3486 |                                                                                                                           |   |   |   | 95% KM (t) UCL                                      | 0.911  |                                                               |   |   |   | 95% KM (Percentile Bootstrap) UCL              | 0.911  |
| 3487 |                                                                                                                           |   |   |   | 95% KM (z) UCL                                      | 0.909  |                                                               |   |   |   | 95% KM Bootstrap t UCL                         | 0.935  |
| 3488 |                                                                                                                           |   |   |   | 90% KM Chebyshev UCL                                | 1.174  |                                                               |   |   |   | 95% KM Chebyshev UCL                           | 1.441  |
| 3489 |                                                                                                                           |   |   |   | 97.5% KM Chebyshev UCL                              | 1.811  |                                                               |   |   |   | 99% KM Chebyshev UCL                           | 2.538  |
| 3490 |                                                                                                                           |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3491 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3492 |                                                                                                                           |   |   |   | A-D Test Statistic                                  | 0.193  |                                                               |   |   |   | <b>Anderson-Darling GOF Test</b>               |        |
| 3493 |                                                                                                                           |   |   |   | 5% A-D Critical Value                               | 0.721  | Detected data appear Gamma Distributed at 5% Significance Lev |   |   |   |                                                |        |
| 3494 |                                                                                                                           |   |   |   | K-S Test Statistic                                  | 0.123  |                                                               |   |   |   | <b>Kolmogorov-Smimov GOF</b>                   |        |
| 3495 |                                                                                                                           |   |   |   | 5% K-S Critical Value                               | 0.279  | Detected data appear Gamma Distributed at 5% Significance Lev |   |   |   |                                                |        |
| 3496 | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                    |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3497 |                                                                                                                           |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3498 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3499 |                                                                                                                           |   |   |   | k hat (MLE)                                         | 16.21  |                                                               |   |   |   | k star (bias corrected MLE)                    | 10.88  |
| 3500 |                                                                                                                           |   |   |   | Theta hat (MLE)                                     | 0.569  |                                                               |   |   |   | Theta star (bias corrected MLE)                | 0.847  |
| 3501 |                                                                                                                           |   |   |   | nu hat (MLE)                                        | 291.8  |                                                               |   |   |   | nu star (bias corrected)                       | 195.8  |
| 3502 |                                                                                                                           |   |   |   | Mean (detects)                                      | 9.218  |                                                               |   |   |   |                                                |        |
| 3503 |                                                                                                                           |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3504 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3505 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3506 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3507 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3508 | This is especially true when the sample size is small.                                                                    |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3509 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3510 |                                                                                                                           |   |   |   | Minimum                                             | 0.01   |                                                               |   |   |   | Mean                                           | 1.04   |
| 3511 |                                                                                                                           |   |   |   | Maximum                                             | 12.8   |                                                               |   |   |   | Median                                         | 0.01   |
| 3512 |                                                                                                                           |   |   |   | SD                                                  | 2.465  |                                                               |   |   |   | CV                                             | 2.37   |
| 3513 |                                                                                                                           |   |   |   | k hat (MLE)                                         | 0.224  |                                                               |   |   |   | k star (bias corrected MLE)                    | 0.224  |
| 3514 |                                                                                                                           |   |   |   | Theta hat (MLE)                                     | 4.649  |                                                               |   |   |   | Theta star (bias corrected MLE)                | 4.649  |
| 3515 |                                                                                                                           |   |   |   | nu hat (MLE)                                        | 66.67  |                                                               |   |   |   | nu star (bias corrected)                       | 66.66  |
| 3516 |                                                                                                                           |   |   |   | Adjusted Level of Significance ( $\beta$ )          | 0.0484 |                                                               |   |   |   |                                                |        |
| 3517 |                                                                                                                           |   |   |   | Approximate Chi Square Value (66.66, $\alpha$ )     | 48.87  |                                                               |   |   |   | Adjusted Chi Square Value (66.66, $\beta$ )    | 48.72  |
| 3518 |                                                                                                                           |   |   |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )   | 1.419  |                                                               |   |   |   | 95% Gamma Adjusted UCL (use when $n < 50$ )    | 1.423  |
| 3519 |                                                                                                                           |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3520 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3521 |                                                                                                                           |   |   |   | Mean (KM)                                           | 0.586  |                                                               |   |   |   | SD (KM)                                        | 2.258  |
| 3522 |                                                                                                                           |   |   |   | Variance (KM)                                       | 5.098  |                                                               |   |   |   | SE of Mean (KM)                                | 0.196  |
| 3523 |                                                                                                                           |   |   |   | k hat (KM)                                          | 0.0673 |                                                               |   |   |   | k star (KM)                                    | 0.0705 |
| 3524 |                                                                                                                           |   |   |   | nu hat (KM)                                         | 20.07  |                                                               |   |   |   | nu star (KM)                                   | 21     |
| 3525 |                                                                                                                           |   |   |   | theta hat (KM)                                      | 8.701  |                                                               |   |   |   | theta star (KM)                                | 8.316  |
| 3526 |                                                                                                                           |   |   |   | 80% gamma percentile (KM)                           | 0.213  |                                                               |   |   |   | 90% gamma percentile (KM)                      | 1.271  |
| 3527 |                                                                                                                           |   |   |   | 95% gamma percentile (KM)                           | 3.373  |                                                               |   |   |   | 99% gamma percentile (KM)                      | 11.01  |
| 3528 |                                                                                                                           |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3529 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3530 |                                                                                                                           |   |   |   | Approximate Chi Square Value (21.00, $\alpha$ )     | 11.59  |                                                               |   |   |   | Adjusted Chi Square Value (21.00, $\beta$ )    | 11.52  |
| 3531 |                                                                                                                           |   |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ ) | 1.062  |                                                               |   |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ ) | 1.068  |
| 3532 |                                                                                                                           |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3533 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3534 |                                                                                                                           |   |   |   | Shapiro Wilk Test Statistic                         | 0.96   |                                                               |   |   |   | <b>Shapiro Wilk GOF Test</b>                   |        |
| 3535 |                                                                                                                           |   |   |   | 5% Shapiro Wilk Critical Value                      | 0.829  | Detected Data appear Lognormal at 5% Significance Level       |   |   |   |                                                |        |
| 3536 |                                                                                                                           |   |   |   | Lilliefors Test Statistic                           | 0.114  |                                                               |   |   |   | <b>Lilliefors GOF Test</b>                     |        |
| 3537 |                                                                                                                           |   |   |   | 5% Lilliefors Critical Value                        | 0.274  | Detected Data appear Lognormal at 5% Significance Level       |   |   |   |                                                |        |
| 3538 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                            |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3539 |                                                                                                                           |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3540 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3541 |                                                                                                                           |   |   |   | Mean in Original Scale                              | 2.402  |                                                               |   |   |   | Mean in Log Scale                              | 0.543  |
| 3542 |                                                                                                                           |   |   |   | SD in Original Scale                                | 2.231  |                                                               |   |   |   | SD in Log Scale                                | 0.819  |
| 3543 |                                                                                                                           |   |   |   | 95% t UCL (assumes normality of ROS data)           | 2.704  |                                                               |   |   |   | 95% Percentile Bootstrap UCL                   | 2.716  |
| 3544 |                                                                                                                           |   |   |   | 95% BCA Bootstrap UCL                               | 2.734  |                                                               |   |   |   | 95% Bootstrap t UCL                            | 2.742  |
| 3545 |                                                                                                                           |   |   |   | 95% H-UCL (Log ROS)                                 | 2.761  |                                                               |   |   |   |                                                |        |
| 3546 |                                                                                                                           |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3547 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |   |   |   |                                                     |        |                                                               |   |   |   |                                                |        |
| 3548 |                                                                                                                           |   |   |   | KM Mean (logged)                                    | -3.132 |                                                               |   |   |   | KM Geo Mean                                    | 0.0436 |
| 3549 |                                                                                                                           |   |   |   | KM SD (logged)                                      | 1.351  |                                                               |   |   |   | 95% Critical H Value (KM-Log)                  | 2.549  |
| 3550 |                                                                                                                           |   |   |   | KM Standard Error of Mean (logged)                  | 0.117  |                                                               |   |   |   | 95% H-UCL (KM -Log)                            | 0.144  |
| 3551 |                                                                                                                           |   |   |   | KM SD (logged)                                      | 1.351  |                                                               |   |   |   | 95% Critical H Value (KM-Log)                  | 2.549  |

|      | A                                                                                                                                        | B | C      | D                                                            | E                                                    | F                 | G                           | H      | I | J     | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|--------------------------------------------------------------|------------------------------------------------------|-------------------|-----------------------------|--------|---|-------|---|---|--|
| 3552 | KM Standard Error of Mean (logged)                                                                                                       |   |        |                                                              |                                                      | 0.117             |                             |        |   |       |   |   |  |
| 3553 |                                                                                                                                          |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3554 | <b>DL/2 Statistics</b>                                                                                                                   |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3555 | <b>DL/2 Normal</b>                                                                                                                       |   |        |                                                              |                                                      |                   | <b>DL/2 Log-Transformed</b> |        |   |       |   |   |  |
| 3556 | Mean in Original Scale                                                                                                                   |   |        |                                                              | 2.505                                                | Mean in Log Scale |                             |        |   | 0.199 |   |   |  |
| 3557 | SD in Original Scale                                                                                                                     |   |        |                                                              | 2.009                                                | SD in Log Scale   |                             |        |   | 1.899 |   |   |  |
| 3558 | 95% t UCL (Assumes normality)                                                                                                            |   |        |                                                              | 2.778                                                | 95% H-Stat UCL    |                             |        |   | 12.16 |   |   |  |
| 3559 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3560 |                                                                                                                                          |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3561 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3562 | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                  |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3563 |                                                                                                                                          |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3564 | <b>Suggested UCL to Use</b>                                                                                                              |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3565 | 95% KM (t) UCL                                                                                                                           |   |        |                                                              | 0.911                                                |                   |                             |        |   |       |   |   |  |
| 3566 |                                                                                                                                          |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3567 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3568 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3569 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3570 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3571 |                                                                                                                                          |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3572 | <b>Result (eu8_zinc)</b>                                                                                                                 |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3573 |                                                                                                                                          |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3574 | <b>General Statistics</b>                                                                                                                |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3575 | Total Number of Observations                                                                                                             |   |        | 149                                                          | Number of Distinct Observations                      |                   |                             | 134    |   |       |   |   |  |
| 3576 | Number of Detects                                                                                                                        |   |        | 148                                                          | Number of Non-Detects                                |                   |                             | 1      |   |       |   |   |  |
| 3577 | Number of Distinct Detects                                                                                                               |   |        | 133                                                          | Number of Distinct Non-Detects                       |                   |                             | 1      |   |       |   |   |  |
| 3578 | Minimum Detect                                                                                                                           |   |        | 14.2                                                         | Minimum Non-Detect                                   |                   |                             | 10     |   |       |   |   |  |
| 3579 | Maximum Detect                                                                                                                           |   |        | 6370                                                         | Maximum Non-Detect                                   |                   |                             | 10     |   |       |   |   |  |
| 3580 | Variance Detects                                                                                                                         |   |        | 1064453                                                      | Percent Non-Detects                                  |                   |                             | 0.6719 |   |       |   |   |  |
| 3581 | Mean Detects                                                                                                                             |   |        | 479.3                                                        | SD Detects                                           |                   |                             | 1032   |   |       |   |   |  |
| 3582 | Median Detects                                                                                                                           |   |        | 181.5                                                        | CV Detects                                           |                   |                             | 2.153  |   |       |   |   |  |
| 3583 | Skewness Detects                                                                                                                         |   |        | 3.758                                                        | Kurtosis Detects                                     |                   |                             | 14.13  |   |       |   |   |  |
| 3584 | Mean of Logged Detects                                                                                                                   |   |        | 5.303                                                        | SD of Logged Detects                                 |                   |                             | 1.11   |   |       |   |   |  |
| 3585 |                                                                                                                                          |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3586 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3587 | Shapiro Wilk Test Statistic                                                                                                              |   |        | 0.42                                                         | <b>Normal GOF Test on Detected Observations Only</b> |                   |                             |        |   |       |   |   |  |
| 3588 | 5% Shapiro Wilk P Value                                                                                                                  |   |        | 0                                                            | Detected Data Not Normal at 5% Significance Level    |                   |                             |        |   |       |   |   |  |
| 3589 | Lilliefors Test Statistic                                                                                                                |   |        | 0.4                                                          | <b>Lilliefors GOF Test</b>                           |                   |                             |        |   |       |   |   |  |
| 3590 | 5% Lilliefors Critical Value                                                                                                             |   |        | 0.0732                                                       | Detected Data Not Normal at 5% Significance Level    |                   |                             |        |   |       |   |   |  |
| 3591 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3592 |                                                                                                                                          |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3593 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3594 | KM Mean                                                                                                                                  |   | 476.2  | KM Standard Error of Mean                                    |                                                      | 84.3              |                             |        |   |       |   |   |  |
| 3595 | KM SD                                                                                                                                    |   | 1025   | 95% KM (BCA) UCL                                             |                                                      | 646               |                             |        |   |       |   |   |  |
| 3596 | 95% KM (t) UCL                                                                                                                           |   | 615.7  | 95% KM (Percentile Bootstrap) UCL                            |                                                      | 627.2             |                             |        |   |       |   |   |  |
| 3597 | 95% KM (z) UCL                                                                                                                           |   | 614.8  | 95% KM Bootstrap t UCL                                       |                                                      | 667.3             |                             |        |   |       |   |   |  |
| 3598 | 90% KM Chebyshev UCL                                                                                                                     |   | 729    | 95% KM Chebyshev UCL                                         |                                                      | 843.6             |                             |        |   |       |   |   |  |
| 3599 | 97.5% KM Chebyshev UCL                                                                                                                   |   | 1003   | 99% KM Chebyshev UCL                                         |                                                      | 1315              |                             |        |   |       |   |   |  |
| 3600 |                                                                                                                                          |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3601 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3602 | A-D Test Statistic                                                                                                                       |   | 14.97  | <b>Anderson-Darling GOF Test</b>                             |                                                      |                   |                             |        |   |       |   |   |  |
| 3603 | 5% A-D Critical Value                                                                                                                    |   | 0.801  | Detected Data Not Gamma Distributed at 5% Significance Level |                                                      |                   |                             |        |   |       |   |   |  |
| 3604 | K-S Test Statistic                                                                                                                       |   | 0.285  | <b>Kolmogorov-Smirnov GOF</b>                                |                                                      |                   |                             |        |   |       |   |   |  |
| 3605 | 5% K-S Critical Value                                                                                                                    |   | 0.0804 | Detected Data Not Gamma Distributed at 5% Significance Level |                                                      |                   |                             |        |   |       |   |   |  |
| 3606 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                                      |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3607 |                                                                                                                                          |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3608 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3609 | k hat (MLE)                                                                                                                              |   | 0.696  | k star (bias corrected MLE)                                  |                                                      | 0.686             |                             |        |   |       |   |   |  |
| 3610 | Theta hat (MLE)                                                                                                                          |   | 688.6  | Theta star (bias corrected MLE)                              |                                                      | 698.2             |                             |        |   |       |   |   |  |
| 3611 | nu hat (MLE)                                                                                                                             |   | 206    | nu star (bias corrected)                                     |                                                      | 203.2             |                             |        |   |       |   |   |  |
| 3612 | Mean (detects)                                                                                                                           |   | 479.3  |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3613 |                                                                                                                                          |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3614 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3615 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3616 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3617 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |
| 3618 | This is especially true when the sample size is small.                                                                                   |   |        |                                                              |                                                      |                   |                             |        |   |       |   |   |  |

| A    | B                                                                                                                                        | C         | D | E                                                    | F     | G                           | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|-----------|---|------------------------------------------------------|-------|-----------------------------|---|---|---|---|---|
| 3619 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |           |   |                                                      |       |                             |   |   |   |   |   |
| 3620 | Minimum                                                                                                                                  | 0.01      |   | Mean                                                 | 476.1 |                             |   |   |   |   |   |
| 3621 | Maximum                                                                                                                                  | 6370      |   | Median                                               | 177   |                             |   |   |   |   |   |
| 3622 | SD                                                                                                                                       | 1029      |   | CV                                                   | 2.161 |                             |   |   |   |   |   |
| 3623 | k hat (MLE)                                                                                                                              | 0.657     |   | k star (bias corrected MLE)                          | 0.648 |                             |   |   |   |   |   |
| 3624 | Theta hat (MLE)                                                                                                                          | 725       |   | Theta star (bias corrected MLE)                      | 734.8 |                             |   |   |   |   |   |
| 3625 | nu hat (MLE)                                                                                                                             | 195.7     |   | nu star (bias corrected)                             | 193.1 |                             |   |   |   |   |   |
| 3626 | Adjusted Level of Significance ( $\beta$ )                                                                                               | 0.0484    |   |                                                      |       |                             |   |   |   |   |   |
| 3627 | Approximate Chi Square Value (193.08, $\alpha$ )                                                                                         | 161.9     |   | Adjusted Chi Square Value (193.08, $\beta$ )         | 161.7 |                             |   |   |   |   |   |
| 3628 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                                        | 567.7     |   | 95% Gamma Adjusted UCL (use when $n < 50$ )          | 568.6 |                             |   |   |   |   |   |
| 3629 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |
| 3630 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |           |   |                                                      |       |                             |   |   |   |   |   |
| 3631 | Mean (KM)                                                                                                                                | 476.2     |   | SD (KM)                                              | 1025  |                             |   |   |   |   |   |
| 3632 | Variance (KM)                                                                                                                            | 1051633   |   | SE of Mean (KM)                                      | 84.3  |                             |   |   |   |   |   |
| 3633 | k hat (KM)                                                                                                                               | 0.216     |   | k star (KM)                                          | 0.216 |                             |   |   |   |   |   |
| 3634 | nu hat (KM)                                                                                                                              | 64.25     |   | nu star (KM)                                         | 64.29 |                             |   |   |   |   |   |
| 3635 | theta hat (KM)                                                                                                                           | 2209      |   | theta star (KM)                                      | 2207  |                             |   |   |   |   |   |
| 3636 | 80% gamma percentile (KM)                                                                                                                | 651.3     |   | 90% gamma percentile (KM)                            | 1439  |                             |   |   |   |   |   |
| 3637 | 95% gamma percentile (KM)                                                                                                                | 2404      |   | 99% gamma percentile (KM)                            | 5029  |                             |   |   |   |   |   |
| 3638 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |
| 3639 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |           |   |                                                      |       |                             |   |   |   |   |   |
| 3640 | Approximate Chi Square Value (64.29, $\alpha$ )                                                                                          | 46.84     |   | Adjusted Chi Square Value (64.29, $\beta$ )          | 46.69 |                             |   |   |   |   |   |
| 3641 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                      | 653.5     |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )       | 655.5 |                             |   |   |   |   |   |
| 3642 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |
| 3643 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |           |   |                                                      |       |                             |   |   |   |   |   |
| 3644 | Shapiro Wilk Approximate Test Statistic                                                                                                  | 0.906     |   | <b>Shapiro Wilk GOF Test</b>                         |       |                             |   |   |   |   |   |
| 3645 | 5% Shapiro Wilk P Value                                                                                                                  | 1.648E-13 |   | Detected Data Not Lognormal at 5% Significance Level |       |                             |   |   |   |   |   |
| 3646 | Lilliefors Test Statistic                                                                                                                | 0.158     |   | <b>Lilliefors GOF Test</b>                           |       |                             |   |   |   |   |   |
| 3647 | 5% Lilliefors Critical Value                                                                                                             | 0.0732    |   | Detected Data Not Lognormal at 5% Significance Level |       |                             |   |   |   |   |   |
| 3648 | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                                              |           |   |                                                      |       |                             |   |   |   |   |   |
| 3649 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |
| 3650 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |           |   |                                                      |       |                             |   |   |   |   |   |
| 3651 | Mean in Original Scale                                                                                                                   | 476.2     |   | Mean in Log Scale                                    | 5.283 |                             |   |   |   |   |   |
| 3652 | SD in Original Scale                                                                                                                     | 1029      |   | SD in Log Scale                                      | 1.133 |                             |   |   |   |   |   |
| 3653 | 95% t UCL (assumes normality of ROS data)                                                                                                | 615.7     |   | 95% Percentile Bootstrap UCL                         | 624.1 |                             |   |   |   |   |   |
| 3654 | 95% BCA Bootstrap UCL                                                                                                                    | 650.1     |   | 95% Bootstrap t UCL                                  | 650.6 |                             |   |   |   |   |   |
| 3655 | 95% H-UCL (Log ROS)                                                                                                                      | 465.1     |   |                                                      |       |                             |   |   |   |   |   |
| 3656 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |
| 3657 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |           |   |                                                      |       |                             |   |   |   |   |   |
| 3658 | KM Mean (logged)                                                                                                                         | 5.283     |   | KM Geo Mean                                          | 197   |                             |   |   |   |   |   |
| 3659 | KM SD (logged)                                                                                                                           | 1.129     |   | 95% Critical H Value (KM-Log)                        | 2.325 |                             |   |   |   |   |   |
| 3660 | KM Standard Error of Mean (logged)                                                                                                       | 0.0928    |   | 95% H-UCL (KM -Log)                                  | 462.5 |                             |   |   |   |   |   |
| 3661 | KM SD (logged)                                                                                                                           | 1.129     |   | 95% Critical H Value (KM-Log)                        | 2.325 |                             |   |   |   |   |   |
| 3662 | KM Standard Error of Mean (logged)                                                                                                       | 0.0928    |   |                                                      |       |                             |   |   |   |   |   |
| 3663 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |
| 3664 | <b>DL/2 Statistics</b>                                                                                                                   |           |   |                                                      |       |                             |   |   |   |   |   |
| 3665 | <b>DL/2 Normal</b>                                                                                                                       |           |   |                                                      |       | <b>DL/2 Log-Transformed</b> |   |   |   |   |   |
| 3666 | Mean in Original Scale                                                                                                                   | 476.1     |   | Mean in Log Scale                                    | 5.279 |                             |   |   |   |   |   |
| 3667 | SD in Original Scale                                                                                                                     | 1029      |   | SD in Log Scale                                      | 1.147 |                             |   |   |   |   |   |
| 3668 | 95% t UCL (Assumes normality)                                                                                                            | 615.6     |   | 95% H-Stat UCL                                       | 471.9 |                             |   |   |   |   |   |
| 3669 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |           |   |                                                      |       |                             |   |   |   |   |   |
| 3670 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |
| 3671 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |           |   |                                                      |       |                             |   |   |   |   |   |
| 3672 | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                            |           |   |                                                      |       |                             |   |   |   |   |   |
| 3673 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |
| 3674 | <b>Suggested UCL to Use</b>                                                                                                              |           |   |                                                      |       |                             |   |   |   |   |   |
| 3675 | 95% KM (Chebyshev) UCL                                                                                                                   | 843.6     |   |                                                      |       |                             |   |   |   |   |   |
| 3676 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |
| 3677 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |           |   |                                                      |       |                             |   |   |   |   |   |
| 3678 | Recommendations are based upon data size, data distribution, and skewness.                                                               |           |   |                                                      |       |                             |   |   |   |   |   |
| 3679 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |           |   |                                                      |       |                             |   |   |   |   |   |
| 3680 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |           |   |                                                      |       |                             |   |   |   |   |   |
| 3681 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |
| 3682 | <b>Result (eu9_aluminum)</b>                                                                                                             |           |   |                                                      |       |                             |   |   |   |   |   |
| 3683 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |
| 3684 | <b>General Statistics</b>                                                                                                                |           |   |                                                      |       |                             |   |   |   |   |   |
| 3685 | Total Number of Observations                                                                                                             | 216       |   | Number of Distinct Observations                      | 189   |                             |   |   |   |   |   |

|      | A                                                                                                                         | B | C | D      | E                                                            | F | G | H      | I | J | K | L |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|--------|--------------------------------------------------------------|---|---|--------|---|---|---|---|
| 3686 | Number of Detects                                                                                                         |   |   | 214    | Number of Non-Detects                                        |   |   | 2      |   |   |   |   |
| 3687 | Number of Distinct Detects                                                                                                |   |   | 188    | Number of Distinct Non-Detects                               |   |   | 1      |   |   |   |   |
| 3688 | Minimum Detect                                                                                                            |   |   | 20.1   | Minimum Non-Detect                                           |   |   | 20     |   |   |   |   |
| 3689 | Maximum Detect                                                                                                            |   |   | 2070   | Maximum Non-Detect                                           |   |   | 20     |   |   |   |   |
| 3690 | Variance Detects                                                                                                          |   |   | 75438  | Percent Non-Detects                                          |   |   | 0.9269 |   |   |   |   |
| 3691 | Mean Detects                                                                                                              |   |   | 276.6  | SD Detects                                                   |   |   | 274.7  |   |   |   |   |
| 3692 | Median Detects                                                                                                            |   |   | 175    | CV Detects                                                   |   |   | 0.993  |   |   |   |   |
| 3693 | Skewness Detects                                                                                                          |   |   | 2.746  | Kurtosis Detects                                             |   |   | 11.58  |   |   |   |   |
| 3694 | Mean of Logged Detects                                                                                                    |   |   | 5.227  | SD of Logged Detects                                         |   |   | 0.911  |   |   |   |   |
| 3695 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3696 | <b>Normal GOF Test on Detects Only</b>                                                                                    |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3697 | Shapiro Wilk Test Statistic                                                                                               |   |   | 0.758  | <b>Normal GOF Test on Detected Observations Only</b>         |   |   |        |   |   |   |   |
| 3698 | 5% Shapiro Wilk P Value                                                                                                   |   |   | 0      | Detected Data Not Normal at 5% Significance Level            |   |   |        |   |   |   |   |
| 3699 | Lilliefors Test Statistic                                                                                                 |   |   | 0.175  | <b>Lilliefors GOF Test</b>                                   |   |   |        |   |   |   |   |
| 3700 | 5% Lilliefors Critical Value                                                                                              |   |   | 0.061  | Detected Data Not Normal at 5% Significance Level            |   |   |        |   |   |   |   |
| 3701 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                  |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3702 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3703 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3704 | KM Mean                                                                                                                   |   |   | 274.3  | KM Standard Error of Mean                                    |   |   | 18.68  |   |   |   |   |
| 3705 | KM SD                                                                                                                     |   |   | 273.9  | 95% KM (BCA) UCL                                             |   |   | 305.2  |   |   |   |   |
| 3706 | 95% KM (t) UCL                                                                                                            |   |   | 305.1  | 95% KM (Percentile Bootstrap) UCL                            |   |   | 307    |   |   |   |   |
| 3707 | 95% KM (z) UCL                                                                                                            |   |   | 305    | 95% KM Bootstrap t UCL                                       |   |   | 311.7  |   |   |   |   |
| 3708 | 90% KM Chebyshev UCL                                                                                                      |   |   | 330.3  | 95% KM Chebyshev UCL                                         |   |   | 355.7  |   |   |   |   |
| 3709 | 97.5% KM Chebyshev UCL                                                                                                    |   |   | 390.9  | 99% KM Chebyshev UCL                                         |   |   | 460.1  |   |   |   |   |
| 3710 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3711 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3712 | A-D Test Statistic                                                                                                        |   |   | 1.687  | <b>Anderson-Darling GOF Test</b>                             |   |   |        |   |   |   |   |
| 3713 | 5% A-D Critical Value                                                                                                     |   |   | 0.774  | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |        |   |   |   |   |
| 3714 | K-S Test Statistic                                                                                                        |   |   | 0.0914 | <b>Kolmogorov-Smirnov GOF</b>                                |   |   |        |   |   |   |   |
| 3715 | 5% K-S Critical Value                                                                                                     |   |   | 0.0633 | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |        |   |   |   |   |
| 3716 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                       |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3717 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3718 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3719 | k hat (MLE)                                                                                                               |   |   | 1.407  | k star (bias corrected MLE)                                  |   |   | 1.39   |   |   |   |   |
| 3720 | Theta hat (MLE)                                                                                                           |   |   | 196.7  | Theta star (bias corrected MLE)                              |   |   | 199    |   |   |   |   |
| 3721 | nu hat (MLE)                                                                                                              |   |   | 602.1  | nu star (bias corrected)                                     |   |   | 595    |   |   |   |   |
| 3722 | Mean (detects)                                                                                                            |   |   | 276.6  |                                                              |   |   |        |   |   |   |   |
| 3723 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3724 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3725 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3726 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3727 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3728 | This is especially true when the sample size is small.                                                                    |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3729 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3730 | Minimum                                                                                                                   |   |   | 0.01   | Mean                                                         |   |   | 274.1  |   |   |   |   |
| 3731 | Maximum                                                                                                                   |   |   | 2070   | Median                                                       |   |   | 174.5  |   |   |   |   |
| 3732 | SD                                                                                                                        |   |   | 274.7  | CV                                                           |   |   | 1.002  |   |   |   |   |
| 3733 | k hat (MLE)                                                                                                               |   |   | 1.186  | k star (bias corrected MLE)                                  |   |   | 1.173  |   |   |   |   |
| 3734 | Theta hat (MLE)                                                                                                           |   |   | 231.1  | Theta star (bias corrected MLE)                              |   |   | 233.7  |   |   |   |   |
| 3735 | nu hat (MLE)                                                                                                              |   |   | 512.4  | nu star (bias corrected)                                     |   |   | 506.6  |   |   |   |   |
| 3736 | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   | 0.0489 |                                                              |   |   |        |   |   |   |   |
| 3737 | Approximate Chi Square Value (506.57, $\alpha$ )                                                                          |   |   | 455.4  | Adjusted Chi Square Value (506.57, $\beta$ )                 |   |   | 455.1  |   |   |   |   |
| 3738 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   | 304.9  | 95% Gamma Adjusted UCL (use when $n < 50$ )                  |   |   | 305.1  |   |   |   |   |
| 3739 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3740 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3741 | Mean (KM)                                                                                                                 |   |   | 274.3  | SD (KM)                                                      |   |   | 273.9  |   |   |   |   |
| 3742 | Variance (KM)                                                                                                             |   |   | 74994  | SE of Mean (KM)                                              |   |   | 18.68  |   |   |   |   |
| 3743 | k hat (KM)                                                                                                                |   |   | 1.003  | k star (KM)                                                  |   |   | 0.992  |   |   |   |   |
| 3744 | nu hat (KM)                                                                                                               |   |   | 433.3  | nu star (KM)                                                 |   |   | 428.6  |   |   |   |   |
| 3745 | theta hat (KM)                                                                                                            |   |   | 273.4  | theta star (KM)                                              |   |   | 276.4  |   |   |   |   |
| 3746 | 80% gamma percentile (KM)                                                                                                 |   |   | 441.7  | 90% gamma percentile (KM)                                    |   |   | 632.7  |   |   |   |   |
| 3747 | 95% gamma percentile (KM)                                                                                                 |   |   | 823.9  | 99% gamma percentile (KM)                                    |   |   | 1268   |   |   |   |   |
| 3748 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3749 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |        |                                                              |   |   |        |   |   |   |   |
| 3750 | Approximate Chi Square Value (428.61, $\alpha$ )                                                                          |   |   | 381.6  | Adjusted Chi Square Value (428.61, $\beta$ )                 |   |   | 381.3  |   |   |   |   |
| 3751 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   |   | 308    | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )               |   |   | 308.3  |   |   |   |   |
| 3752 |                                                                                                                           |   |   |        |                                                              |   |   |        |   |   |   |   |

| A    | B                                                                                                                                        | C | D      | E                                                       | F | G | H | I      | J | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|--------|---------------------------------------------------------|---|---|---|--------|---|---|---|--|
| 3753 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3754 | Shapiro Wilk Approximate Test Statistic                                                                                                  |   | 0.978  | <b>Shapiro Wilk GOF Test</b>                            |   |   |   |        |   |   |   |  |
| 3755 | 5% Shapiro Wilk P Value                                                                                                                  |   | 0.177  | Detected Data appear Lognormal at 5% Significance Level |   |   |   |        |   |   |   |  |
| 3756 | Lilliefors Test Statistic                                                                                                                |   | 0.0538 | <b>Lilliefors GOF Test</b>                              |   |   |   |        |   |   |   |  |
| 3757 | 5% Lilliefors Critical Value                                                                                                             |   | 0.061  | Detected Data appear Lognormal at 5% Significance Level |   |   |   |        |   |   |   |  |
| 3758 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                           |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3759 |                                                                                                                                          |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3760 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3761 | Mean in Original Scale                                                                                                                   |   | 274.2  | Mean in Log Scale                                       |   |   |   | 5.204  |   |   |   |  |
| 3762 | SD in Original Scale                                                                                                                     |   | 274.5  | SD in Log Scale                                         |   |   |   | 0.939  |   |   |   |  |
| 3763 | 95% t UCL (assumes normality of ROS data)                                                                                                |   | 305.1  | 95% Percentile Bootstrap UCL                            |   |   |   | 305.6  |   |   |   |  |
| 3764 | 95% BCA Bootstrap UCL                                                                                                                    |   | 312.9  | 95% Bootstrap t UCL                                     |   |   |   | 310.1  |   |   |   |  |
| 3765 | 95% H-UCL (Log ROS)                                                                                                                      |   | 323.3  |                                                         |   |   |   |        |   |   |   |  |
| 3766 |                                                                                                                                          |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3767 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3768 | KM Mean (logged)                                                                                                                         |   | 5.206  | KM Geo Mean                                             |   |   |   | 182.4  |   |   |   |  |
| 3769 | KM SD (logged)                                                                                                                           |   | 0.93   | 95% Critical H Value (KM-Log)                           |   |   |   | 2.09   |   |   |   |  |
| 3770 | KM Standard Error of Mean (logged)                                                                                                       |   | 0.0634 | 95% H-UCL (KM -Log)                                     |   |   |   | 320.9  |   |   |   |  |
| 3771 | KM SD (logged)                                                                                                                           |   | 0.93   | 95% Critical H Value (KM-Log)                           |   |   |   | 2.09   |   |   |   |  |
| 3772 | KM Standard Error of Mean (logged)                                                                                                       |   | 0.0634 |                                                         |   |   |   |        |   |   |   |  |
| 3773 |                                                                                                                                          |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3774 | <b>DL/2 Statistics</b>                                                                                                                   |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3775 | <b>DL/2 Normal</b>                                                                                                                       |   |        | <b>DL/2 Log-Transformed</b>                             |   |   |   |        |   |   |   |  |
| 3776 | Mean in Original Scale                                                                                                                   |   | 274.2  | Mean in Log Scale                                       |   |   |   | 5.2    |   |   |   |  |
| 3777 | SD in Original Scale                                                                                                                     |   | 274.6  | SD in Log Scale                                         |   |   |   | 0.95   |   |   |   |  |
| 3778 | 95% t UCL (Assumes normality)                                                                                                            |   | 305    | 95% H-Stat UCL                                          |   |   |   | 326.1  |   |   |   |  |
| 3779 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3780 |                                                                                                                                          |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3781 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3782 | <b>Detected Data appear Lognormal Distributed at 5% Significance Level</b>                                                               |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3783 |                                                                                                                                          |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3784 | <b>Suggested UCL to Use</b>                                                                                                              |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3785 | KM H-UCL                                                                                                                                 |   | 320.9  |                                                         |   |   |   |        |   |   |   |  |
| 3786 |                                                                                                                                          |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3787 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3788 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3789 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3790 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3791 |                                                                                                                                          |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3792 | <b>Result (eu9_antimony)</b>                                                                                                             |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3793 |                                                                                                                                          |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3794 | <b>General Statistics</b>                                                                                                                |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3795 | Total Number of Observations                                                                                                             |   | 194    | Number of Distinct Observations                         |   |   |   | 6      |   |   |   |  |
| 3796 | Number of Detects                                                                                                                        |   | 3      | Number of Non-Detects                                   |   |   |   | 191    |   |   |   |  |
| 3797 | Number of Distinct Detects                                                                                                               |   | 3      | Number of Distinct Non-Detects                          |   |   |   | 3      |   |   |   |  |
| 3798 | Minimum Detect                                                                                                                           |   | 4.42   | Minimum Non-Detect                                      |   |   |   | 0.047  |   |   |   |  |
| 3799 | Maximum Detect                                                                                                                           |   | 5.04   | Maximum Non-Detect                                      |   |   |   | 2.5    |   |   |   |  |
| 3800 | Variance Detects                                                                                                                         |   | 0.105  | Percent Non-Detects                                     |   |   |   | 98.45% |   |   |   |  |
| 3801 | Mean Detects                                                                                                                             |   | 4.783  | SD Detects                                              |   |   |   | 0.323  |   |   |   |  |
| 3802 | Median Detects                                                                                                                           |   | 4.89   | CV Detects                                              |   |   |   | 0.0676 |   |   |   |  |
| 3803 | Skewness Detects                                                                                                                         |   | -1.323 | Kurtosis Detects                                        |   |   |   | N/A    |   |   |   |  |
| 3804 | Mean of Logged Detects                                                                                                                   |   | 1.564  | SD of Logged Detects                                    |   |   |   | 0.0687 |   |   |   |  |
| 3805 |                                                                                                                                          |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3806 | <b>Warning: Data set has only 3 Detected Values.</b>                                                                                     |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3807 | <b>This is not enough to compute meaningful or reliable statistics and estimates.</b>                                                    |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3808 |                                                                                                                                          |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3809 |                                                                                                                                          |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3810 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3811 | Shapiro Wilk Test Statistic                                                                                                              |   | 0.918  | <b>Shapiro Wilk GOF Test</b>                            |   |   |   |        |   |   |   |  |
| 3812 | 5% Shapiro Wilk Critical Value                                                                                                           |   | 0.767  | Detected Data appear Normal at 5% Significance Level    |   |   |   |        |   |   |   |  |
| 3813 | Lilliefors Test Statistic                                                                                                                |   | 0.296  | <b>Lilliefors GOF Test</b>                              |   |   |   |        |   |   |   |  |
| 3814 | 5% Lilliefors Critical Value                                                                                                             |   | 0.425  | Detected Data appear Normal at 5% Significance Level    |   |   |   |        |   |   |   |  |
| 3815 | <b>Detected Data appear Normal at 5% Significance Level</b>                                                                              |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3816 |                                                                                                                                          |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3817 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |        |                                                         |   |   |   |        |   |   |   |  |
| 3818 | KM Mean                                                                                                                                  |   | 0.12   | KM Standard Error of Mean                               |   |   |   | 0.0515 |   |   |   |  |
| 3819 | KM SD                                                                                                                                    |   | 0.585  | 95% KM (BCA) UCL                                        |   |   |   | N/A    |   |   |   |  |

|      | A                                                                                                                         | B | C | D                                                   | E      | F     | G                                 | H | I | J                                                       | K      | L |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|-----------------------------------------------------|--------|-------|-----------------------------------|---|---|---------------------------------------------------------|--------|---|
| 3820 |                                                                                                                           |   |   | 95% KM (t) UCL                                      |        | 0.205 | 95% KM (Percentile Bootstrap) UCL |   |   |                                                         | N/A    |   |
| 3821 |                                                                                                                           |   |   | 95% KM (z) UCL                                      |        | 0.205 | 95% KM Bootstrap t UCL            |   |   |                                                         | N/A    |   |
| 3822 |                                                                                                                           |   |   | 90% KM Chebyshev UCL                                |        | 0.275 | 95% KM Chebyshev UCL              |   |   |                                                         | 0.345  |   |
| 3823 |                                                                                                                           |   |   | 97.5% KM Chebyshev UCL                              |        | 0.442 | 99% KM Chebyshev UCL              |   |   |                                                         | 0.632  |   |
| 3824 |                                                                                                                           |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3825 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3826 | <b>Not Enough Data to Perform GOF Test</b>                                                                                |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3827 |                                                                                                                           |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3828 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3829 |                                                                                                                           |   |   | k hat (MLE)                                         | 321    |       |                                   |   |   | k star (bias corrected MLE)                             | N/A    |   |
| 3830 |                                                                                                                           |   |   | Theta hat (MLE)                                     | 0.0149 |       |                                   |   |   | Theta star (bias corrected MLE)                         | N/A    |   |
| 3831 |                                                                                                                           |   |   | nu hat (MLE)                                        | 1926   |       |                                   |   |   | nu star (bias corrected)                                | N/A    |   |
| 3832 |                                                                                                                           |   |   | Mean (detects)                                      | 4.783  |       |                                   |   |   |                                                         |        |   |
| 3833 |                                                                                                                           |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3834 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3835 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3836 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3837 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3838 | This is especially true when the sample size is small.                                                                    |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3839 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3840 |                                                                                                                           |   |   | Minimum                                             | 0.01   |       |                                   |   |   | Mean                                                    | 1.429  |   |
| 3841 |                                                                                                                           |   |   | Maximum                                             | 5.04   |       |                                   |   |   | Median                                                  | 1.282  |   |
| 3842 |                                                                                                                           |   |   | SD                                                  | 1.162  |       |                                   |   |   | CV                                                      | 0.814  |   |
| 3843 |                                                                                                                           |   |   | k hat (MLE)                                         | 0.679  |       |                                   |   |   | k star (bias corrected MLE)                             | 0.672  |   |
| 3844 |                                                                                                                           |   |   | Theta hat (MLE)                                     | 2.105  |       |                                   |   |   | Theta star (bias corrected MLE)                         | 2.127  |   |
| 3845 |                                                                                                                           |   |   | nu hat (MLE)                                        | 263.4  |       |                                   |   |   | nu star (bias corrected)                                | 260.6  |   |
| 3846 |                                                                                                                           |   |   | Adjusted Level of Significance ( $\beta$ )          | 0.0488 |       |                                   |   |   |                                                         |        |   |
| 3847 |                                                                                                                           |   |   | Approximate Chi Square Value (260.63, $\alpha$ )    | 224.3  |       |                                   |   |   | Adjusted Chi Square Value (260.63, $\beta$ )            | 224    |   |
| 3848 |                                                                                                                           |   |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )   | 1.66   |       |                                   |   |   | 95% Gamma Adjusted UCL (use when $n < 50$ )             | N/A    |   |
| 3849 |                                                                                                                           |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3850 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3851 |                                                                                                                           |   |   | Mean (KM)                                           | 0.12   |       |                                   |   |   | SD (KM)                                                 | 0.585  |   |
| 3852 |                                                                                                                           |   |   | Variance (KM)                                       | 0.343  |       |                                   |   |   | SE of Mean (KM)                                         | 0.0515 |   |
| 3853 |                                                                                                                           |   |   | k hat (KM)                                          | 0.0422 |       |                                   |   |   | k star (KM)                                             | 0.045  |   |
| 3854 |                                                                                                                           |   |   | nu hat (KM)                                         | 16.37  |       |                                   |   |   | nu star (KM)                                            | 17.45  |   |
| 3855 |                                                                                                                           |   |   | theta hat (KM)                                      | 2.849  |       |                                   |   |   | theta star (KM)                                         | 2.673  |   |
| 3856 |                                                                                                                           |   |   | 80% gamma percentile (KM)                           | 0.0109 |       |                                   |   |   | 90% gamma percentile (KM)                               | 0.158  |   |
| 3857 |                                                                                                                           |   |   | 95% gamma percentile (KM)                           | 0.613  |       |                                   |   |   | 99% gamma percentile (KM)                               | 2.724  |   |
| 3858 |                                                                                                                           |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3859 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3860 |                                                                                                                           |   |   | Approximate Chi Square Value (17.45, $\alpha$ )     | 8.997  |       |                                   |   |   | Adjusted Chi Square Value (17.45, $\beta$ )             | 8.952  |   |
| 3861 |                                                                                                                           |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ ) | 0.233  |       |                                   |   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )          | 0.234  |   |
| 3862 |                                                                                                                           |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3863 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3864 |                                                                                                                           |   |   | Shapiro Wilk Test Statistic                         | 0.911  |       |                                   |   |   | <b>Shapiro Wilk GOF Test</b>                            |        |   |
| 3865 |                                                                                                                           |   |   | 5% Shapiro Wilk Critical Value                      | 0.767  |       |                                   |   |   | Detected Data appear Lognormal at 5% Significance Level |        |   |
| 3866 |                                                                                                                           |   |   | Lilliefors Test Statistic                           | 0.301  |       |                                   |   |   | <b>Lilliefors GOF Test</b>                              |        |   |
| 3867 |                                                                                                                           |   |   | 5% Lilliefors Critical Value                        | 0.425  |       |                                   |   |   | Detected Data appear Lognormal at 5% Significance Level |        |   |
| 3868 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                            |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3869 |                                                                                                                           |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3870 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3871 |                                                                                                                           |   |   | Mean in Original Scale                              | 2.317  |       |                                   |   |   | Mean in Log Scale                                       | 0.794  |   |
| 3872 |                                                                                                                           |   |   | SD in Original Scale                                | 0.724  |       |                                   |   |   | SD in Log Scale                                         | 0.305  |   |
| 3873 |                                                                                                                           |   |   | 95% t UCL (assumes normality of ROS data)           | 2.403  |       |                                   |   |   | 95% Percentile Bootstrap UCL                            | 2.403  |   |
| 3874 |                                                                                                                           |   |   | 95% BCA Bootstrap UCL                               | 2.414  |       |                                   |   |   | 95% Bootstrap t UCL                                     | 2.41   |   |
| 3875 |                                                                                                                           |   |   | 95% H-UCL (Log ROS)                                 | 2.407  |       |                                   |   |   |                                                         |        |   |
| 3876 |                                                                                                                           |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3877 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3878 |                                                                                                                           |   |   | KM Mean (logged)                                    | -2.986 |       |                                   |   |   | KM Geo Mean                                             | 0.0505 |   |
| 3879 |                                                                                                                           |   |   | KM SD (logged)                                      | 0.57   |       |                                   |   |   | 95% Critical H Value (KM-Log)                           | 1.856  |   |
| 3880 |                                                                                                                           |   |   | KM Standard Error of Mean (logged)                  | 0.0501 |       |                                   |   |   | 95% H-UCL (KM -Log)                                     | 0.0641 |   |
| 3881 |                                                                                                                           |   |   | KM SD (logged)                                      | 0.57   |       |                                   |   |   | 95% Critical H Value (KM-Log)                           | 1.856  |   |
| 3882 |                                                                                                                           |   |   | KM Standard Error of Mean (logged)                  | 0.0501 |       |                                   |   |   |                                                         |        |   |
| 3883 |                                                                                                                           |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3884 | <b>DL/2 Statistics</b>                                                                                                    |   |   |                                                     |        |       |                                   |   |   |                                                         |        |   |
| 3885 | <b>DL/2 Normal</b>                                                                                                        |   |   |                                                     |        |       | <b>DL/2 Log-Transformed</b>       |   |   |                                                         |        |   |
| 3886 |                                                                                                                           |   |   | Mean in Original Scale                              | 1.241  |       |                                   |   |   | Mean in Log Scale                                       | 0.0394 |   |

| A    | B                                                                                                                                        | C | D                              | E | F      | G | H | I | J                                                               | K | L      |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|--------------------------------|---|--------|---|---|---|-----------------------------------------------------------------|---|--------|
| 3887 |                                                                                                                                          |   | SD in Original Scale           |   | 0.522  |   |   |   | SD in Log Scale                                                 |   | 0.9    |
| 3888 |                                                                                                                                          |   | 95% t UCL (Assumes normality)  |   | 1.303  |   |   |   | 95% H-Stat UCL                                                  |   | 1.785  |
| 3889 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3890 |                                                                                                                                          |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3891 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3892 | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                  |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3893 |                                                                                                                                          |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3894 | <b>Suggested UCL to Use</b>                                                                                                              |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3895 |                                                                                                                                          |   | 95% KM (t) UCL                 |   | 0.205  |   |   |   |                                                                 |   |        |
| 3896 |                                                                                                                                          |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3897 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3898 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3899 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3900 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3901 |                                                                                                                                          |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3902 | <b>Result (eu9_arsenic)</b>                                                                                                              |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3903 |                                                                                                                                          |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3904 | <b>General Statistics</b>                                                                                                                |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3905 |                                                                                                                                          |   | Total Number of Observations   |   | 213    |   |   |   | Number of Distinct Observations                                 |   | 9      |
| 3906 |                                                                                                                                          |   | Number of Detects              |   | 7      |   |   |   | Number of Non-Detects                                           |   | 206    |
| 3907 |                                                                                                                                          |   | Number of Distinct Detects     |   | 7      |   |   |   | Number of Distinct Non-Detects                                  |   | 2      |
| 3908 |                                                                                                                                          |   | Minimum Detect                 |   | 0.17   |   |   |   | Minimum Non-Detect                                              |   | 0.026  |
| 3909 |                                                                                                                                          |   | Maximum Detect                 |   | 3.17   |   |   |   | Maximum Non-Detect                                              |   | 2.5    |
| 3910 |                                                                                                                                          |   | Variance Detects               |   | 1.874  |   |   |   | Percent Non-Detects                                             |   | 96.71% |
| 3911 |                                                                                                                                          |   | Mean Detects                   |   | 1.351  |   |   |   | SD Detects                                                      |   | 1.369  |
| 3912 |                                                                                                                                          |   | Median Detects                 |   | 0.37   |   |   |   | CV Detects                                                      |   | 1.013  |
| 3913 |                                                                                                                                          |   | Skewness Detects               |   | 0.441  |   |   |   | Kurtosis Detects                                                |   | -2.507 |
| 3914 |                                                                                                                                          |   | Mean of Logged Detects         |   | -0.343 |   |   |   | SD of Logged Detects                                            |   | 1.302  |
| 3915 |                                                                                                                                          |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3916 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3917 |                                                                                                                                          |   | Shapiro Wilk Test Statistic    |   | 0.76   |   |   |   | <b>Shapiro Wilk GOF Test</b>                                    |   |        |
| 3918 |                                                                                                                                          |   | 5% Shapiro Wilk Critical Value |   | 0.803  |   |   |   | Detected Data Not Normal at 5% Significance Level               |   |        |
| 3919 |                                                                                                                                          |   | Lilliefors Test Statistic      |   | 0.335  |   |   |   | <b>Lilliefors GOF Test</b>                                      |   |        |
| 3920 |                                                                                                                                          |   | 5% Lilliefors Critical Value   |   | 0.304  |   |   |   | Detected Data Not Normal at 5% Significance Level               |   |        |
| 3921 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3922 |                                                                                                                                          |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3923 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3924 |                                                                                                                                          |   | KM Mean                        |   | 0.159  |   |   |   | KM Standard Error of Mean                                       |   | 0.0485 |
| 3925 |                                                                                                                                          |   | KM SD                          |   | 0.341  |   |   |   | 95% KM (BCA) UCL                                                |   | 0.243  |
| 3926 |                                                                                                                                          |   | 95% KM (t) UCL                 |   | 0.239  |   |   |   | 95% KM (Percentile Bootstrap) UCL                               |   | 0.24   |
| 3927 |                                                                                                                                          |   | 95% KM (z) UCL                 |   | 0.239  |   |   |   | 95% KM Bootstrap t UCL                                          |   | 0.238  |
| 3928 |                                                                                                                                          |   | 90% KM Chebyshev UCL           |   | 0.305  |   |   |   | 95% KM Chebyshev UCL                                            |   | 0.371  |
| 3929 |                                                                                                                                          |   | 97.5% KM Chebyshev UCL         |   | 0.462  |   |   |   | 99% KM Chebyshev UCL                                            |   | 0.642  |
| 3930 |                                                                                                                                          |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3931 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3932 |                                                                                                                                          |   | A-D Test Statistic             |   | 0.819  |   |   |   | <b>Anderson-Darling GOF Test</b>                                |   |        |
| 3933 |                                                                                                                                          |   | 5% A-D Critical Value          |   | 0.731  |   |   |   | Detected Data Not Gamma Distributed at 5% Significance Level    |   |        |
| 3934 |                                                                                                                                          |   | K-S Test Statistic             |   | 0.31   |   |   |   | <b>Kolmogorov-Smirnov GOF</b>                                   |   |        |
| 3935 |                                                                                                                                          |   | 5% K-S Critical Value          |   | 0.321  |   |   |   | Detected data appear Gamma Distributed at 5% Significance Level |   |        |
| 3936 | <b>Detected data follow Appr. Gamma Distribution at 5% Significance Level</b>                                                            |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3937 |                                                                                                                                          |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3938 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3939 |                                                                                                                                          |   | k hat (MLE)                    |   | 0.907  |   |   |   | k star (bias corrected MLE)                                     |   | 0.614  |
| 3940 |                                                                                                                                          |   | Theta hat (MLE)                |   | 1.489  |   |   |   | Theta star (bias corrected MLE)                                 |   | 2.202  |
| 3941 |                                                                                                                                          |   | nu hat (MLE)                   |   | 12.7   |   |   |   | nu star (bias corrected)                                        |   | 8.592  |
| 3942 |                                                                                                                                          |   | Mean (detects)                 |   | 1.351  |   |   |   |                                                                 |   |        |
| 3943 |                                                                                                                                          |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3944 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3945 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3946 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3947 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3948 | This is especially true when the sample size is small.                                                                                   |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3949 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |   |                                |   |        |   |   |   |                                                                 |   |        |
| 3950 |                                                                                                                                          |   | Minimum                        |   | 0.01   |   |   |   | Mean                                                            |   | 0.208  |
| 3951 |                                                                                                                                          |   | Maximum                        |   | 3.17   |   |   |   | Median                                                          |   | 0.01   |
| 3952 |                                                                                                                                          |   | SD                             |   | 0.476  |   |   |   | CV                                                              |   | 2.292  |
| 3953 |                                                                                                                                          |   | k hat (MLE)                    |   | 0.347  |   |   |   | k star (bias corrected MLE)                                     |   | 0.345  |

| A    | B | C | D | E                                                                                                                                        | F      | G | H | I                           | J                                                       | K | L      |
|------|---|---|---|------------------------------------------------------------------------------------------------------------------------------------------|--------|---|---|-----------------------------|---------------------------------------------------------|---|--------|
| 3954 |   |   |   | Theta hat (MLE)                                                                                                                          | 0.599  |   |   |                             | Theta star (bias corrected MLE)                         |   | 0.602  |
| 3955 |   |   |   | nu hat (MLE)                                                                                                                             | 147.9  |   |   |                             | nu star (bias corrected)                                |   | 147.2  |
| 3956 |   |   |   | Adjusted Level of Significance ( $\beta$ )                                                                                               | 0.0489 |   |   |                             |                                                         |   |        |
| 3957 |   |   |   | Approximate Chi Square Value (147.17, $\alpha$ )                                                                                         | 120.1  |   |   |                             | Adjusted Chi Square Value (147.17, $\beta$ )            |   | 120    |
| 3958 |   |   |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                                        | 0.255  |   |   |                             | 95% Gamma Adjusted UCL (use when $n < 50$ )             |   | 0.255  |
| 3959 |   |   |   | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |        |   |   |                             |                                                         |   |        |
| 3960 |   |   |   | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |        |   |   |                             |                                                         |   |        |
| 3961 |   |   |   | Mean (KM)                                                                                                                                | 0.159  |   |   |                             | SD (KM)                                                 |   | 0.341  |
| 3962 |   |   |   | Variance (KM)                                                                                                                            | 0.116  |   |   |                             | SE of Mean (KM)                                         |   | 0.0485 |
| 3963 |   |   |   | k hat (KM)                                                                                                                               | 0.218  |   |   |                             | k star (KM)                                             |   | 0.218  |
| 3964 |   |   |   | nu hat (KM)                                                                                                                              | 93.01  |   |   |                             | nu star (KM)                                            |   | 93.03  |
| 3965 |   |   |   | theta hat (KM)                                                                                                                           | 0.73   |   |   |                             | theta star (KM)                                         |   | 0.73   |
| 3966 |   |   |   | 80% gamma percentile (KM)                                                                                                                | 0.219  |   |   |                             | 90% gamma percentile (KM)                               |   | 0.481  |
| 3967 |   |   |   | 95% gamma percentile (KM)                                                                                                                | 0.802  |   |   |                             | 99% gamma percentile (KM)                               |   | 1.672  |
| 3968 |   |   |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |        |   |   |                             |                                                         |   |        |
| 3969 |   |   |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |        |   |   |                             |                                                         |   |        |
| 3970 |   |   |   | Approximate Chi Square Value (93.03, $\alpha$ )                                                                                          | 71.79  |   |   |                             | Adjusted Chi Square Value (93.03, $\beta$ )             |   | 71.66  |
| 3971 |   |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                      | 0.206  |   |   |                             | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )          |   | 0.207  |
| 3972 |   |   |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |        |   |   |                             |                                                         |   |        |
| 3973 |   |   |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |        |   |   |                             |                                                         |   |        |
| 3974 |   |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.809  |   |   |                             | <b>Shapiro Wilk GOF Test</b>                            |   |        |
| 3975 |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                           | 0.803  |   |   |                             | Detected Data appear Lognormal at 5% Significance Level |   |        |
| 3976 |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.268  |   |   |                             | <b>Lilliefors GOF Test</b>                              |   |        |
| 3977 |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.304  |   |   |                             | Detected Data appear Lognormal at 5% Significance Level |   |        |
| 3978 |   |   |   | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                           |        |   |   |                             |                                                         |   |        |
| 3979 |   |   |   | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |        |   |   |                             |                                                         |   |        |
| 3980 |   |   |   | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |        |   |   |                             |                                                         |   |        |
| 3981 |   |   |   | Mean in Original Scale                                                                                                                   | 0.205  |   |   |                             | Mean in Log Scale                                       |   | -2.501 |
| 3982 |   |   |   | SD in Original Scale                                                                                                                     | 0.389  |   |   |                             | SD in Log Scale                                         |   | 1.366  |
| 3983 |   |   |   | 95% t UCL (assumes normality of ROS data)                                                                                                | 0.249  |   |   |                             | 95% Percentile Bootstrap UCL                            |   | 0.252  |
| 3984 |   |   |   | 95% BCA Bootstrap UCL                                                                                                                    | 0.258  |   |   |                             | 95% Bootstrap t UCL                                     |   | 0.263  |
| 3985 |   |   |   | 95% H-UCL (Log ROS)                                                                                                                      | 0.263  |   |   |                             |                                                         |   |        |
| 3986 |   |   |   | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |        |   |   |                             |                                                         |   |        |
| 3987 |   |   |   | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |        |   |   |                             |                                                         |   |        |
| 3988 |   |   |   | KM Mean (logged)                                                                                                                         | -2.684 |   |   |                             | KM Geo Mean                                             |   | 0.0683 |
| 3989 |   |   |   | KM SD (logged)                                                                                                                           | 1.209  |   |   |                             | 95% Critical H Value (KM-Log)                           |   | 2.33   |
| 3990 |   |   |   | KM Standard Error of Mean (logged)                                                                                                       | 0.383  |   |   |                             | 95% H-UCL (KM -Log)                                     |   | 0.172  |
| 3991 |   |   |   | KM SD (logged)                                                                                                                           | 1.209  |   |   |                             | 95% Critical H Value (KM-Log)                           |   | 2.33   |
| 3992 |   |   |   | KM Standard Error of Mean (logged)                                                                                                       | 0.383  |   |   |                             |                                                         |   |        |
| 3993 |   |   |   | <b>DL/2 Statistics</b>                                                                                                                   |        |   |   |                             |                                                         |   |        |
| 3994 |   |   |   | <b>DL/2 Statistics</b>                                                                                                                   |        |   |   |                             |                                                         |   |        |
| 3995 |   |   |   | <b>DL/2 Normal</b>                                                                                                                       |        |   |   | <b>DL/2 Log-Transformed</b> |                                                         |   |        |
| 3996 |   |   |   | Mean in Original Scale                                                                                                                   | 1.218  |   |   |                             | Mean in Log Scale                                       |   | 0.0759 |
| 3997 |   |   |   | SD in Original Scale                                                                                                                     | 0.309  |   |   |                             | SD in Log Scale                                         |   | 0.792  |
| 3998 |   |   |   | 95% t UCL (Assumes normality)                                                                                                            | 1.254  |   |   |                             | 95% H-Stat UCL                                          |   | 1.644  |
| 3999 |   |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |        |   |   |                             |                                                         |   |        |
| 4000 |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |   |   |                             |                                                         |   |        |
| 4001 |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |   |   |                             |                                                         |   |        |
| 4002 |   |   |   | <b>Detected Data appear Approximate Gamma Distributed at 5% Significance Level</b>                                                       |        |   |   |                             |                                                         |   |        |
| 4003 |   |   |   | <b>Detected Data appear Approximate Gamma Distributed at 5% Significance Level</b>                                                       |        |   |   |                             |                                                         |   |        |
| 4004 |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |        |   |   |                             |                                                         |   |        |
| 4005 |   |   |   | 95% KM Approximate Gamma UCL                                                                                                             | 0.206  |   |   |                             |                                                         |   |        |
| 4006 |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |        |   |   |                             |                                                         |   |        |
| 4007 |   |   |   | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test                                           |        |   |   |                             |                                                         |   |        |
| 4008 |   |   |   | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL                   |        |   |   |                             |                                                         |   |        |
| 4009 |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |        |   |   |                             |                                                         |   |        |
| 4010 |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |   |   |                             |                                                         |   |        |
| 4011 |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |   |   |                             |                                                         |   |        |
| 4012 |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |   |   |                             |                                                         |   |        |
| 4013 |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |   |   |                             |                                                         |   |        |
| 4014 |   |   |   | <b>Result (eu9_beryllium)</b>                                                                                                            |        |   |   |                             |                                                         |   |        |
| 4015 |   |   |   | <b>Result (eu9_beryllium)</b>                                                                                                            |        |   |   |                             |                                                         |   |        |
| 4016 |   |   |   | <b>Result (eu9_beryllium)</b>                                                                                                            |        |   |   |                             |                                                         |   |        |
| 4017 |   |   |   | <b>General Statistics</b>                                                                                                                |        |   |   |                             |                                                         |   |        |
| 4018 |   |   |   | Total Number of Observations                                                                                                             | 213    |   |   |                             | Number of Distinct Observations                         |   | 6      |
| 4019 |   |   |   | Number of Detects                                                                                                                        | 4      |   |   |                             | Number of Non-Detects                                   |   | 209    |
| 4020 |   |   |   | Number of Distinct Detects                                                                                                               | 4      |   |   |                             | Number of Distinct Non-Detects                          |   | 2      |

| A    | B | C | D                                                                                                                         | E      | F | G                                                               | H | I | J                    | K      | L |
|------|---|---|---------------------------------------------------------------------------------------------------------------------------|--------|---|-----------------------------------------------------------------|---|---|----------------------|--------|---|
| 4021 |   |   | Minimum Detect                                                                                                            | 0.11   |   |                                                                 |   |   | Minimum Non-Detect   | 0.043  |   |
| 4022 |   |   | Maximum Detect                                                                                                            | 0.73   |   |                                                                 |   |   | Maximum Non-Detect   | 2      |   |
| 4023 |   |   | Variance Detects                                                                                                          | 0.0653 |   |                                                                 |   |   | Percent Non-Detects  | 98.12% |   |
| 4024 |   |   | Mean Detects                                                                                                              | 0.39   |   |                                                                 |   |   | SD Detects           | 0.256  |   |
| 4025 |   |   | Median Detects                                                                                                            | 0.36   |   |                                                                 |   |   | CV Detects           | 0.655  |   |
| 4026 |   |   | Skewness Detects                                                                                                          | 0.69   |   |                                                                 |   |   | Kurtosis Detects     | 1.738  |   |
| 4027 |   |   | Mean of Logged Detects                                                                                                    | -1.142 |   |                                                                 |   |   | SD of Logged Detects | 0.785  |   |
| 4028 |   |   |                                                                                                                           |        |   |                                                                 |   |   |                      |        |   |
| 4029 |   |   | <b>Normal GOF Test on Detects Only</b>                                                                                    |        |   |                                                                 |   |   |                      |        |   |
| 4030 |   |   | Shapiro Wilk Test Statistic                                                                                               | 0.941  |   | <b>Shapiro Wilk GOF Test</b>                                    |   |   |                      |        |   |
| 4031 |   |   | 5% Shapiro Wilk Critical Value                                                                                            | 0.748  |   | Detected Data appear Normal at 5% Significance Level            |   |   |                      |        |   |
| 4032 |   |   | Lilliefors Test Statistic                                                                                                 | 0.281  |   | <b>Lilliefors GOF Test</b>                                      |   |   |                      |        |   |
| 4033 |   |   | 5% Lilliefors Critical Value                                                                                              | 0.375  |   | Detected Data appear Normal at 5% Significance Level            |   |   |                      |        |   |
| 4034 |   |   | <b>Detected Data appear Normal at 5% Significance Level</b>                                                               |        |   |                                                                 |   |   |                      |        |   |
| 4035 |   |   |                                                                                                                           |        |   |                                                                 |   |   |                      |        |   |
| 4036 |   |   | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |        |   |                                                                 |   |   |                      |        |   |
| 4037 |   |   | KM Mean                                                                                                                   | 0.182  |   | KM Standard Error of Mean                                       |   |   |                      | 0.0804 |   |
| 4038 |   |   | KM SD                                                                                                                     | 0.22   |   | 95% KM (BCA) UCL                                                |   |   |                      | N/A    |   |
| 4039 |   |   | 95% KM (t) UCL                                                                                                            | 0.315  |   | 95% KM (Percentile Bootstrap) UCL                               |   |   |                      | N/A    |   |
| 4040 |   |   | 95% KM (z) UCL                                                                                                            | 0.314  |   | 95% KM Bootstrap t UCL                                          |   |   |                      | N/A    |   |
| 4041 |   |   | 90% KM Chebyshev UCL                                                                                                      | 0.423  |   | 95% KM Chebyshev UCL                                            |   |   |                      | 0.532  |   |
| 4042 |   |   | 97.5% KM Chebyshev UCL                                                                                                    | 0.684  |   | 99% KM Chebyshev UCL                                            |   |   |                      | 0.982  |   |
| 4043 |   |   |                                                                                                                           |        |   |                                                                 |   |   |                      |        |   |
| 4044 |   |   | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |        |   |                                                                 |   |   |                      |        |   |
| 4045 |   |   | A-D Test Statistic                                                                                                        | 0.308  |   | <b>Anderson-Darling GOF Test</b>                                |   |   |                      |        |   |
| 4046 |   |   | 5% A-D Critical Value                                                                                                     | 0.66   |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |                      |        |   |
| 4047 |   |   | K-S Test Statistic                                                                                                        | 0.264  |   | <b>Kolmogorov-Smirnov GOF</b>                                   |   |   |                      |        |   |
| 4048 |   |   | 5% K-S Critical Value                                                                                                     | 0.397  |   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |                      |        |   |
| 4049 |   |   | <b>Detected data appear Gamma Distributed at 5% Significance Level</b>                                                    |        |   |                                                                 |   |   |                      |        |   |
| 4050 |   |   |                                                                                                                           |        |   |                                                                 |   |   |                      |        |   |
| 4051 |   |   | <b>Gamma Statistics on Detected Data Only</b>                                                                             |        |   |                                                                 |   |   |                      |        |   |
| 4052 |   |   | k hat (MLE)                                                                                                               | 2.656  |   | k star (bias corrected MLE)                                     |   |   |                      | 0.831  |   |
| 4053 |   |   | Theta hat (MLE)                                                                                                           | 0.147  |   | Theta star (bias corrected MLE)                                 |   |   |                      | 0.469  |   |
| 4054 |   |   | nu hat (MLE)                                                                                                              | 21.25  |   | nu star (bias corrected)                                        |   |   |                      | 6.645  |   |
| 4055 |   |   | Mean (detects)                                                                                                            | 0.39   |   |                                                                 |   |   |                      |        |   |
| 4056 |   |   |                                                                                                                           |        |   |                                                                 |   |   |                      |        |   |
| 4057 |   |   | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |        |   |                                                                 |   |   |                      |        |   |
| 4058 |   |   | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |        |   |                                                                 |   |   |                      |        |   |
| 4059 |   |   | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |        |   |                                                                 |   |   |                      |        |   |
| 4060 |   |   | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |        |   |                                                                 |   |   |                      |        |   |
| 4061 |   |   | This is especially true when the sample size is small.                                                                    |        |   |                                                                 |   |   |                      |        |   |
| 4062 |   |   | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |        |   |                                                                 |   |   |                      |        |   |
| 4063 |   |   | Minimum                                                                                                                   | 0.01   |   | Mean                                                            |   |   |                      | 0.182  |   |
| 4064 |   |   | Maximum                                                                                                                   | 1.706  |   | Median                                                          |   |   |                      | 0.01   |   |
| 4065 |   |   | SD                                                                                                                        | 0.307  |   | CV                                                              |   |   |                      | 1.684  |   |
| 4066 |   |   | k hat (MLE)                                                                                                               | 0.43   |   | k star (bias corrected MLE)                                     |   |   |                      | 0.427  |   |
| 4067 |   |   | Theta hat (MLE)                                                                                                           | 0.424  |   | Theta star (bias corrected MLE)                                 |   |   |                      | 0.427  |   |
| 4068 |   |   | nu hat (MLE)                                                                                                              | 183.1  |   | nu star (bias corrected)                                        |   |   |                      | 181.9  |   |
| 4069 |   |   | Adjusted Level of Significance ( $\beta$ )                                                                                | 0.0489 |   |                                                                 |   |   |                      |        |   |
| 4070 |   |   | Approximate Chi Square Value (181.86, $\alpha$ )                                                                          | 151.7  |   | Adjusted Chi Square Value (181.86, $\beta$ )                    |   |   |                      | 151.5  |   |
| 4071 |   |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         | 0.219  |   | 95% Gamma Adjusted UCL (use when $n < 50$ )                     |   |   |                      | N/A    |   |
| 4072 |   |   |                                                                                                                           |        |   |                                                                 |   |   |                      |        |   |
| 4073 |   |   | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |        |   |                                                                 |   |   |                      |        |   |
| 4074 |   |   | Mean (KM)                                                                                                                 | 0.182  |   | SD (KM)                                                         |   |   |                      | 0.22   |   |
| 4075 |   |   | Variance (KM)                                                                                                             | 0.0485 |   | SE of Mean (KM)                                                 |   |   |                      | 0.0804 |   |
| 4076 |   |   | k hat (KM)                                                                                                                | 0.681  |   | k star (KM)                                                     |   |   |                      | 0.675  |   |
| 4077 |   |   | nu hat (KM)                                                                                                               | 290.3  |   | nu star (KM)                                                    |   |   |                      | 287.6  |   |
| 4078 |   |   | theta hat (KM)                                                                                                            | 0.267  |   | theta star (KM)                                                 |   |   |                      | 0.269  |   |
| 4079 |   |   | 80% gamma percentile (KM)                                                                                                 | 0.299  |   | 90% gamma percentile (KM)                                       |   |   |                      | 0.46   |   |
| 4080 |   |   | 95% gamma percentile (KM)                                                                                                 | 0.627  |   | 99% gamma percentile (KM)                                       |   |   |                      | 1.026  |   |
| 4081 |   |   |                                                                                                                           |        |   |                                                                 |   |   |                      |        |   |
| 4082 |   |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |        |   |                                                                 |   |   |                      |        |   |
| 4083 |   |   | Approximate Chi Square Value (287.56, $\alpha$ )                                                                          | 249.3  |   | Adjusted Chi Square Value (287.56, $\beta$ )                    |   |   |                      | 249    |   |
| 4084 |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       | 0.21   |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )                  |   |   |                      | 0.21   |   |
| 4085 |   |   |                                                                                                                           |        |   |                                                                 |   |   |                      |        |   |
| 4086 |   |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |        |   |                                                                 |   |   |                      |        |   |
| 4087 |   |   | Shapiro Wilk Test Statistic                                                                                               | 0.928  |   | <b>Shapiro Wilk GOF Test</b>                                    |   |   |                      |        |   |

| A    | B                                                                                                                                        | C | D | E      | F                                                       | G | H | I      | J | K | L |  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|---------------------------------------------------------|---|---|--------|---|---|---|--|
| 4088 | 5% Shapiro Wilk Critical Value                                                                                                           |   |   | 0.748  | Detected Data appear Lognormal at 5% Significance Level |   |   |        |   |   |   |  |
| 4089 | Lilliefors Test Statistic                                                                                                                |   |   | 0.296  | <b>Lilliefors GOF Test</b>                              |   |   |        |   |   |   |  |
| 4090 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.375  | Detected Data appear Lognormal at 5% Significance Level |   |   |        |   |   |   |  |
| 4091 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                           |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4092 |                                                                                                                                          |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4093 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4094 | Mean in Original Scale                                                                                                                   |   |   | 0.266  | Mean in Log Scale                                       |   |   | -2.741 |   |   |   |  |
| 4095 | SD in Original Scale                                                                                                                     |   |   | 0.665  | SD in Log Scale                                         |   |   | 1.745  |   |   |   |  |
| 4096 | 95% t UCL (assumes normality of ROS data)                                                                                                |   |   | 0.342  | 95% Percentile Bootstrap UCL                            |   |   | 0.348  |   |   |   |  |
| 4097 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 0.366  | 95% Bootstrap t UCL                                     |   |   | 0.372  |   |   |   |  |
| 4098 | 95% H-UCL (Log ROS)                                                                                                                      |   |   | 0.417  |                                                         |   |   |        |   |   |   |  |
| 4099 |                                                                                                                                          |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4100 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4101 | KM Mean (logged)                                                                                                                         |   |   | -2.345 | KM Geo Mean                                             |   |   | 0.0959 |   |   |   |  |
| 4102 | KM SD (logged)                                                                                                                           |   |   | 1.072  | 95% Critical H Value (KM-Log)                           |   |   | 2.208  |   |   |   |  |
| 4103 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.392  | 95% H-UCL (KM -Log)                                     |   |   | 0.2    |   |   |   |  |
| 4104 | KM SD (logged)                                                                                                                           |   |   | 1.072  | 95% Critical H Value (KM-Log)                           |   |   | 2.208  |   |   |   |  |
| 4105 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.392  |                                                         |   |   |        |   |   |   |  |
| 4106 |                                                                                                                                          |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4107 | <b>DL/2 Statistics</b>                                                                                                                   |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4108 | <b>DL/2 Normal</b>                                                                                                                       |   |   |        | <b>DL/2 Log-Transformed</b>                             |   |   |        |   |   |   |  |
| 4109 | Mean in Original Scale                                                                                                                   |   |   | 0.961  | Mean in Log Scale                                       |   |   | -0.13  |   |   |   |  |
| 4110 | SD in Original Scale                                                                                                                     |   |   | 0.183  | SD in Log Scale                                         |   |   | 0.659  |   |   |   |  |
| 4111 | 95% t UCL (Assumes normality)                                                                                                            |   |   | 0.982  | 95% H-Stat UCL                                          |   |   | 1.189  |   |   |   |  |
| 4112 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4113 |                                                                                                                                          |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4114 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4115 | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                                  |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4116 |                                                                                                                                          |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4117 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4118 | 95% KM (t) UCL                                                                                                                           |   |   | 0.315  |                                                         |   |   |        |   |   |   |  |
| 4119 |                                                                                                                                          |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4120 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4121 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4122 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4123 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4124 |                                                                                                                                          |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4125 | <b>Result (eu9_cadmium)</b>                                                                                                              |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4126 |                                                                                                                                          |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4127 | <b>General Statistics</b>                                                                                                                |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4128 | Total Number of Observations                                                                                                             |   |   | 216    | Number of Distinct Observations                         |   |   | 156    |   |   |   |  |
| 4129 | Number of Detects                                                                                                                        |   |   | 191    | Number of Non-Detects                                   |   |   | 25     |   |   |   |  |
| 4130 | Number of Distinct Detects                                                                                                               |   |   | 154    | Number of Distinct Non-Detects                          |   |   | 2      |   |   |   |  |
| 4131 | Minimum Detect                                                                                                                           |   |   | 0.506  | Minimum Non-Detect                                      |   |   | 0.05   |   |   |   |  |
| 4132 | Maximum Detect                                                                                                                           |   |   | 23.7   | Maximum Non-Detect                                      |   |   | 0.5    |   |   |   |  |
| 4133 | Variance Detects                                                                                                                         |   |   | 6.968  | Percent Non-Detects                                     |   |   | 11.57% |   |   |   |  |
| 4134 | Mean Detects                                                                                                                             |   |   | 1.614  | SD Detects                                              |   |   | 2.64   |   |   |   |  |
| 4135 | Median Detects                                                                                                                           |   |   | 1.06   | CV Detects                                              |   |   | 1.636  |   |   |   |  |
| 4136 | Skewness Detects                                                                                                                         |   |   | 6.474  | Kurtosis Detects                                        |   |   | 45.07  |   |   |   |  |
| 4137 | Mean of Logged Detects                                                                                                                   |   |   | 0.168  | SD of Logged Detects                                    |   |   | 0.6    |   |   |   |  |
| 4138 |                                                                                                                                          |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4139 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4140 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.329  | <b>Normal GOF Test on Detected Observations Only</b>    |   |   |        |   |   |   |  |
| 4141 | 5% Shapiro Wilk P Value                                                                                                                  |   |   | 0      | Detected Data Not Normal at 5% Significance Level       |   |   |        |   |   |   |  |
| 4142 | Lilliefors Test Statistic                                                                                                                |   |   | 0.337  | <b>Lilliefors GOF Test</b>                              |   |   |        |   |   |   |  |
| 4143 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.0645 | Detected Data Not Normal at 5% Significance Level       |   |   |        |   |   |   |  |
| 4144 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4145 |                                                                                                                                          |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4146 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4147 | KM Mean                                                                                                                                  |   |   | 1.433  | KM Standard Error of Mean                               |   |   | 0.172  |   |   |   |  |
| 4148 | KM SD                                                                                                                                    |   |   | 2.526  | 95% KM (BCA) UCL                                        |   |   | 1.738  |   |   |   |  |
| 4149 | 95% KM (t) UCL                                                                                                                           |   |   | 1.717  | 95% KM (Percentile Bootstrap) UCL                       |   |   | 1.742  |   |   |   |  |
| 4150 | 95% KM (z) UCL                                                                                                                           |   |   | 1.716  | 95% KM Bootstrap t UCL                                  |   |   | 1.896  |   |   |   |  |
| 4151 | 90% KM Chebyshev UCL                                                                                                                     |   |   | 1.95   | 95% KM Chebyshev UCL                                    |   |   | 2.184  |   |   |   |  |
| 4152 | 97.5% KM Chebyshev UCL                                                                                                                   |   |   | 2.509  | 99% KM Chebyshev UCL                                    |   |   | 3.147  |   |   |   |  |
| 4153 |                                                                                                                                          |   |   |        |                                                         |   |   |        |   |   |   |  |
| 4154 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |   |   |        |                                                         |   |   |        |   |   |   |  |

|      | A                                                                                                                         | B | C | D      | E | F                                                            | G                           | H | I       | J | K | L |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|--------|---|--------------------------------------------------------------|-----------------------------|---|---------|---|---|---|
| 4155 | A-D Test Statistic                                                                                                        |   |   | 17.62  |   | <b>Anderson-Darling GOF Test</b>                             |                             |   |         |   |   |   |
| 4156 | 5% A-D Critical Value                                                                                                     |   |   | 0.769  |   | Detected Data Not Gamma Distributed at 5% Significance Level |                             |   |         |   |   |   |
| 4157 | K-S Test Statistic                                                                                                        |   |   | 0.216  |   | <b>Kolmogorov-Smirnov GOF</b>                                |                             |   |         |   |   |   |
| 4158 | 5% K-S Critical Value                                                                                                     |   |   | 0.067  |   | Detected Data Not Gamma Distributed at 5% Significance Level |                             |   |         |   |   |   |
| 4159 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                       |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4160 |                                                                                                                           |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4161 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4162 | k hat (MLE)                                                                                                               |   |   | 1.759  |   | k star (bias corrected MLE)                                  |                             |   | 1.735   |   |   |   |
| 4163 | Theta hat (MLE)                                                                                                           |   |   | 0.918  |   | Theta star (bias corrected MLE)                              |                             |   | 0.93    |   |   |   |
| 4164 | nu hat (MLE)                                                                                                              |   |   | 671.9  |   | nu star (bias corrected)                                     |                             |   | 662.6   |   |   |   |
| 4165 | Mean (detects)                                                                                                            |   |   | 1.614  |   |                                                              |                             |   |         |   |   |   |
| 4166 |                                                                                                                           |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4167 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4168 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4169 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4170 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4171 | This is especially true when the sample size is small.                                                                    |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4172 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4173 | Minimum                                                                                                                   |   |   | 0.01   |   | Mean                                                         |                             |   | 1.428   |   |   |   |
| 4174 | Maximum                                                                                                                   |   |   | 23.7   |   | Median                                                       |                             |   | 0.973   |   |   |   |
| 4175 | SD                                                                                                                        |   |   | 2.534  |   | CV                                                           |                             |   | 1.775   |   |   |   |
| 4176 | k hat (MLE)                                                                                                               |   |   | 0.801  |   | k star (bias corrected MLE)                                  |                             |   | 0.793   |   |   |   |
| 4177 | Theta hat (MLE)                                                                                                           |   |   | 1.783  |   | Theta star (bias corrected MLE)                              |                             |   | 1.801   |   |   |   |
| 4178 | nu hat (MLE)                                                                                                              |   |   | 346.1  |   | nu star (bias corrected)                                     |                             |   | 342.6   |   |   |   |
| 4179 | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   | 0.0489 |   |                                                              |                             |   |         |   |   |   |
| 4180 | Approximate Chi Square Value (342.60, $\alpha$ )                                                                          |   |   | 300.7  |   | Adjusted Chi Square Value (342.60, $\beta$ )                 |                             |   | 300.4   |   |   |   |
| 4181 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   | 1.627  |   | 95% Gamma Adjusted UCL (use when $n < 50$ )                  |                             |   | 1.628   |   |   |   |
| 4182 |                                                                                                                           |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4183 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4184 | Mean (KM)                                                                                                                 |   |   | 1.433  |   | SD (KM)                                                      |                             |   | 2.526   |   |   |   |
| 4185 | Variance (KM)                                                                                                             |   |   | 6.38   |   | SE of Mean (KM)                                              |                             |   | 0.172   |   |   |   |
| 4186 | k hat (KM)                                                                                                                |   |   | 0.322  |   | k star (KM)                                                  |                             |   | 0.32    |   |   |   |
| 4187 | nu hat (KM)                                                                                                               |   |   | 139    |   | nu star (KM)                                                 |                             |   | 138.4   |   |   |   |
| 4188 | theta hat (KM)                                                                                                            |   |   | 4.453  |   | theta star (KM)                                              |                             |   | 4.472   |   |   |   |
| 4189 | 80% gamma percentile (KM)                                                                                                 |   |   | 2.231  |   | 90% gamma percentile (KM)                                    |                             |   | 4.19    |   |   |   |
| 4190 | 95% gamma percentile (KM)                                                                                                 |   |   | 6.416  |   | 99% gamma percentile (KM)                                    |                             |   | 12.15   |   |   |   |
| 4191 |                                                                                                                           |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4192 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4193 | Approximate Chi Square Value (138.40, $\alpha$ )                                                                          |   |   | 112.2  |   | Adjusted Chi Square Value (138.40, $\beta$ )                 |                             |   | 112.1   |   |   |   |
| 4194 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   |   | 1.767  |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )               |                             |   | 1.769   |   |   |   |
| 4195 |                                                                                                                           |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4196 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4197 | Shapiro Wilk Approximate Test Statistic                                                                                   |   |   | 0.824  |   | <b>Shapiro Wilk GOF Test</b>                                 |                             |   |         |   |   |   |
| 4198 | 5% Shapiro Wilk P Value                                                                                                   |   |   | 0      |   | Detected Data Not Lognormal at 5% Significance Level         |                             |   |         |   |   |   |
| 4199 | Lilliefors Test Statistic                                                                                                 |   |   | 0.129  |   | <b>Lilliefors GOF Test</b>                                   |                             |   |         |   |   |   |
| 4200 | 5% Lilliefors Critical Value                                                                                              |   |   | 0.0645 |   | Detected Data Not Lognormal at 5% Significance Level         |                             |   |         |   |   |   |
| 4201 | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                               |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4202 |                                                                                                                           |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4203 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4204 | Mean in Original Scale                                                                                                    |   |   | 1.466  |   | Mean in Log Scale                                            |                             |   | 0.0201  |   |   |   |
| 4205 | SD in Original Scale                                                                                                      |   |   | 2.515  |   | SD in Log Scale                                              |                             |   | 0.702   |   |   |   |
| 4206 | 95% t UCL (assumes normality of ROS data)                                                                                 |   |   | 1.749  |   | 95% Percentile Bootstrap UCL                                 |                             |   | 1.768   |   |   |   |
| 4207 | 95% BCA Bootstrap UCL                                                                                                     |   |   | 1.843  |   | 95% Bootstrap t UCL                                          |                             |   | 1.892   |   |   |   |
| 4208 | 95% H-UCL (Log ROS)                                                                                                       |   |   | 1.431  |   |                                                              |                             |   |         |   |   |   |
| 4209 |                                                                                                                           |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4210 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4211 | KM Mean (logged)                                                                                                          |   |   | -0.198 |   | KM Geo Mean                                                  |                             |   | 0.82    |   |   |   |
| 4212 | KM SD (logged)                                                                                                            |   |   | 1.158  |   | 95% Critical H Value (KM-Log)                                |                             |   | 2.285   |   |   |   |
| 4213 | KM Standard Error of Mean (logged)                                                                                        |   |   | 0.079  |   | 95% H-UCL (KM -Log)                                          |                             |   | 1.921   |   |   |   |
| 4214 | KM SD (logged)                                                                                                            |   |   | 1.158  |   | 95% Critical H Value (KM-Log)                                |                             |   | 2.285   |   |   |   |
| 4215 | KM Standard Error of Mean (logged)                                                                                        |   |   | 0.079  |   |                                                              |                             |   |         |   |   |   |
| 4216 |                                                                                                                           |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4217 | <b>DL/2 Statistics</b>                                                                                                    |   |   |        |   |                                                              |                             |   |         |   |   |   |
| 4218 | <b>DL/2 Normal</b>                                                                                                        |   |   |        |   |                                                              | <b>DL/2 Log-Transformed</b> |   |         |   |   |   |
| 4219 | Mean in Original Scale                                                                                                    |   |   | 1.452  |   | Mean in Log Scale                                            |                             |   | -0.0545 |   |   |   |
| 4220 | SD in Original Scale                                                                                                      |   |   | 2.522  |   | SD in Log Scale                                              |                             |   | 0.884   |   |   |   |
| 4221 | 95% t UCL (Assumes normality)                                                                                             |   |   | 1.735  |   | 95% H-Stat UCL                                               |                             |   | 1.584   |   |   |   |

| A    | B                                                                                                                                           | C | D       | E | F                                                            | G | H | I | J       | K | L |
|------|---------------------------------------------------------------------------------------------------------------------------------------------|---|---------|---|--------------------------------------------------------------|---|---|---|---------|---|---|
| 4222 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                    |   |         |   |                                                              |   |   |   |         |   |   |
| 4223 |                                                                                                                                             |   |         |   |                                                              |   |   |   |         |   |   |
| 4224 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                       |   |         |   |                                                              |   |   |   |         |   |   |
| 4225 | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                               |   |         |   |                                                              |   |   |   |         |   |   |
| 4226 |                                                                                                                                             |   |         |   |                                                              |   |   |   |         |   |   |
| 4227 | <b>Suggested UCL to Use</b>                                                                                                                 |   |         |   |                                                              |   |   |   |         |   |   |
| 4228 | 95% KM (Chebyshev) UCL                                                                                                                      |   | 2.184   |   |                                                              |   |   |   |         |   |   |
| 4229 |                                                                                                                                             |   |         |   |                                                              |   |   |   |         |   |   |
| 4230 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.                |   |         |   |                                                              |   |   |   |         |   |   |
| 4231 | Recommendations are based upon data size, data distribution, and skewness.                                                                  |   |         |   |                                                              |   |   |   |         |   |   |
| 4232 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                    |   |         |   |                                                              |   |   |   |         |   |   |
| 4233 | However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.    |   |         |   |                                                              |   |   |   |         |   |   |
| 4234 |                                                                                                                                             |   |         |   |                                                              |   |   |   |         |   |   |
| 4235 | <b>Result (eu9_chromium)</b>                                                                                                                |   |         |   |                                                              |   |   |   |         |   |   |
| 4236 |                                                                                                                                             |   |         |   |                                                              |   |   |   |         |   |   |
| 4237 | <b>General Statistics</b>                                                                                                                   |   |         |   |                                                              |   |   |   |         |   |   |
| 4238 | Total Number of Observations                                                                                                                |   | 216     |   | Number of Distinct Observations                              |   |   |   | 4       |   |   |
| 4239 | Number of Detects                                                                                                                           |   | 1       |   | Number of Non-Detects                                        |   |   |   | 215     |   |   |
| 4240 | Number of Distinct Detects                                                                                                                  |   | 1       |   | Number of Distinct Non-Detects                               |   |   |   | 3       |   |   |
| 4241 |                                                                                                                                             |   |         |   |                                                              |   |   |   |         |   |   |
| 4242 | <b>Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!</b>            |   |         |   |                                                              |   |   |   |         |   |   |
| 4243 | <b>Suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, B)</b> |   |         |   |                                                              |   |   |   |         |   |   |
| 4244 |                                                                                                                                             |   |         |   |                                                              |   |   |   |         |   |   |
| 4245 | <b>The data set for variable Result (eu9_chromium) was not processed!</b>                                                                   |   |         |   |                                                              |   |   |   |         |   |   |
| 4246 |                                                                                                                                             |   |         |   |                                                              |   |   |   |         |   |   |
| 4247 |                                                                                                                                             |   |         |   |                                                              |   |   |   |         |   |   |
| 4248 | <b>Result (eu9_cobalt)</b>                                                                                                                  |   |         |   |                                                              |   |   |   |         |   |   |
| 4249 |                                                                                                                                             |   |         |   |                                                              |   |   |   |         |   |   |
| 4250 | <b>General Statistics</b>                                                                                                                   |   |         |   |                                                              |   |   |   |         |   |   |
| 4251 | Total Number of Observations                                                                                                                |   | 126     |   | Number of Distinct Observations                              |   |   |   | 35      |   |   |
| 4252 | Number of Detects                                                                                                                           |   | 36      |   | Number of Non-Detects                                        |   |   |   | 90      |   |   |
| 4253 | Number of Distinct Detects                                                                                                                  |   | 34      |   | Number of Distinct Non-Detects                               |   |   |   | 1       |   |   |
| 4254 | Minimum Detect                                                                                                                              |   | 0.06    |   | Minimum Non-Detect                                           |   |   |   | 0.5     |   |   |
| 4255 | Maximum Detect                                                                                                                              |   | 1.38    |   | Maximum Non-Detect                                           |   |   |   | 0.5     |   |   |
| 4256 | Variance Detects                                                                                                                            |   | 0.0882  |   | Percent Non-Detects                                          |   |   |   | 71.43%  |   |   |
| 4257 | Mean Detects                                                                                                                                |   | 0.69    |   | SD Detects                                                   |   |   |   | 0.297   |   |   |
| 4258 | Median Detects                                                                                                                              |   | 0.682   |   | CV Detects                                                   |   |   |   | 0.431   |   |   |
| 4259 | Skewness Detects                                                                                                                            |   | -0.0115 |   | Kurtosis Detects                                             |   |   |   | -0.0739 |   |   |
| 4260 | Mean of Logged Detects                                                                                                                      |   | -0.508  |   | SD of Logged Detects                                         |   |   |   | 0.62    |   |   |
| 4261 |                                                                                                                                             |   |         |   |                                                              |   |   |   |         |   |   |
| 4262 | <b>Normal GOF Test on Detects Only</b>                                                                                                      |   |         |   |                                                              |   |   |   |         |   |   |
| 4263 | Shapiro Wilk Test Statistic                                                                                                                 |   | 0.981   |   | <b>Shapiro Wilk GOF Test</b>                                 |   |   |   |         |   |   |
| 4264 | 5% Shapiro Wilk Critical Value                                                                                                              |   | 0.935   |   | Detected Data appear Normal at 5% Significance Level         |   |   |   |         |   |   |
| 4265 | Lilliefors Test Statistic                                                                                                                   |   | 0.0912  |   | <b>Lilliefors GOF Test</b>                                   |   |   |   |         |   |   |
| 4266 | 5% Lilliefors Critical Value                                                                                                                |   | 0.145   |   | Detected Data appear Normal at 5% Significance Level         |   |   |   |         |   |   |
| 4267 | <b>Detected Data appear Normal at 5% Significance Level</b>                                                                                 |   |         |   |                                                              |   |   |   |         |   |   |
| 4268 |                                                                                                                                             |   |         |   |                                                              |   |   |   |         |   |   |
| 4269 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                               |   |         |   |                                                              |   |   |   |         |   |   |
| 4270 | KM Mean                                                                                                                                     |   | 0.393   |   | KM Standard Error of Mean                                    |   |   |   | 0.0473  |   |   |
| 4271 | KM SD                                                                                                                                       |   | 0.272   |   | 95% KM (BCA) UCL                                             |   |   |   | 0.48    |   |   |
| 4272 | 95% KM (t) UCL                                                                                                                              |   | 0.471   |   | 95% KM (Percentile Bootstrap) UCL                            |   |   |   | 0.472   |   |   |
| 4273 | 95% KM (z) UCL                                                                                                                              |   | 0.471   |   | 95% KM Bootstrap t UCL                                       |   |   |   | 0.495   |   |   |
| 4274 | 90% KM Chebyshev UCL                                                                                                                        |   | 0.535   |   | 95% KM Chebyshev UCL                                         |   |   |   | 0.599   |   |   |
| 4275 | 97.5% KM Chebyshev UCL                                                                                                                      |   | 0.688   |   | 99% KM Chebyshev UCL                                         |   |   |   | 0.864   |   |   |
| 4276 |                                                                                                                                             |   |         |   |                                                              |   |   |   |         |   |   |
| 4277 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                        |   |         |   |                                                              |   |   |   |         |   |   |
| 4278 | A-D Test Statistic                                                                                                                          |   | 0.982   |   | <b>Anderson-Darling GOF Test</b>                             |   |   |   |         |   |   |
| 4279 | 5% A-D Critical Value                                                                                                                       |   | 0.753   |   | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |   |         |   |   |
| 4280 | K-S Test Statistic                                                                                                                          |   | 0.158   |   | <b>Kolmogorov-Smirnov GOF</b>                                |   |   |   |         |   |   |
| 4281 | 5% K-S Critical Value                                                                                                                       |   | 0.148   |   | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |   |         |   |   |
| 4282 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                                         |   |         |   |                                                              |   |   |   |         |   |   |
| 4283 |                                                                                                                                             |   |         |   |                                                              |   |   |   |         |   |   |
| 4284 | <b>Gamma Statistics on Detected Data Only</b>                                                                                               |   |         |   |                                                              |   |   |   |         |   |   |
| 4285 | k hat (MLE)                                                                                                                                 |   | 3.817   |   | k star (bias corrected MLE)                                  |   |   |   | 3.518   |   |   |
| 4286 | Theta hat (MLE)                                                                                                                             |   | 0.181   |   | Theta star (bias corrected MLE)                              |   |   |   | 0.196   |   |   |
| 4287 | nu hat (MLE)                                                                                                                                |   | 274.9   |   | nu star (bias corrected)                                     |   |   |   | 253.3   |   |   |
| 4288 | Mean (detects)                                                                                                                              |   | 0.69    |   |                                                              |   |   |   |         |   |   |

| A    | B                                                                                                                            | C      | D | E                                                    | F      | G                           | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------|--------|---|------------------------------------------------------|--------|-----------------------------|---|---|---|---|---|
| 4289 |                                                                                                                              |        |   |                                                      |        |                             |   |   |   |   |   |
| 4290 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                        |        |   |                                                      |        |                             |   |   |   |   |   |
| 4291 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                 |        |   |                                                      |        |                             |   |   |   |   |   |
| 4292 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)    |        |   |                                                      |        |                             |   |   |   |   |   |
| 4293 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                 |        |   |                                                      |        |                             |   |   |   |   |   |
| 4294 | This is especially true when the sample size is small.                                                                       |        |   |                                                      |        |                             |   |   |   |   |   |
| 4295 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                  |        |   |                                                      |        |                             |   |   |   |   |   |
| 4296 | Minimum                                                                                                                      | 0.01   |   | Mean                                                 | 0.372  |                             |   |   |   |   |   |
| 4297 | Maximum                                                                                                                      | 1.38   |   | Median                                               | 0.322  |                             |   |   |   |   |   |
| 4298 | SD                                                                                                                           | 0.29   |   | CV                                                   | 0.778  |                             |   |   |   |   |   |
| 4299 | k hat (MLE)                                                                                                                  | 1.205  |   | k star (bias corrected CV)                           | 1.182  |                             |   |   |   |   |   |
| 4300 | Theta hat (MLE)                                                                                                              | 0.309  |   | Theta star (bias corrected MLE)                      | 0.315  |                             |   |   |   |   |   |
| 4301 | nu hat (MLE)                                                                                                                 | 303.8  |   | nu star (bias corrected)                             | 297.9  |                             |   |   |   |   |   |
| 4302 | Adjusted Level of Significance ( $\beta$ )                                                                                   | 0.0481 |   |                                                      |        |                             |   |   |   |   |   |
| 4303 | Approximate Chi Square Value (297.88, $\alpha$ )                                                                             | 258.9  |   | Adjusted Chi Square Value (297.88, $\beta$ )         | 258.5  |                             |   |   |   |   |   |
| 4304 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                            | 0.428  |   | 95% Gamma Adjusted UCL (use when $n < 50$ )          | 0.429  |                             |   |   |   |   |   |
| 4305 |                                                                                                                              |        |   |                                                      |        |                             |   |   |   |   |   |
| 4306 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                      |        |   |                                                      |        |                             |   |   |   |   |   |
| 4307 | Mean (KM)                                                                                                                    | 0.393  |   | SD (KM)                                              | 0.272  |                             |   |   |   |   |   |
| 4308 | Variance (KM)                                                                                                                | 0.0741 |   | SE of Mean (KM)                                      | 0.0473 |                             |   |   |   |   |   |
| 4309 | k hat (KM)                                                                                                                   | 2.082  |   | k star (KM)                                          | 2.038  |                             |   |   |   |   |   |
| 4310 | nu hat (KM)                                                                                                                  | 524.8  |   | nu star (KM)                                         | 513.6  |                             |   |   |   |   |   |
| 4311 | theta hat (KM)                                                                                                               | 0.189  |   | theta star (KM)                                      | 0.193  |                             |   |   |   |   |   |
| 4312 | 80% gamma percentile (KM)                                                                                                    | 0.587  |   | 90% gamma percentile (KM)                            | 0.761  |                             |   |   |   |   |   |
| 4313 | 95% gamma percentile (KM)                                                                                                    | 0.926  |   | 99% gamma percentile (KM)                            | 1.293  |                             |   |   |   |   |   |
| 4314 |                                                                                                                              |        |   |                                                      |        |                             |   |   |   |   |   |
| 4315 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                    |        |   |                                                      |        |                             |   |   |   |   |   |
| 4316 | Approximate Chi Square Value (513.62, $\alpha$ )                                                                             | 462.1  |   | Adjusted Chi Square Value (513.62, $\beta$ )         | 461.5  |                             |   |   |   |   |   |
| 4317 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                          | 0.437  |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )       | 0.437  |                             |   |   |   |   |   |
| 4318 |                                                                                                                              |        |   |                                                      |        |                             |   |   |   |   |   |
| 4319 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                      |        |   |                                                      |        |                             |   |   |   |   |   |
| 4320 | Shapiro Wilk Test Statistic                                                                                                  | 0.836  |   | <b>Shapiro Wilk GOF Test</b>                         |        |                             |   |   |   |   |   |
| 4321 | 5% Shapiro Wilk Critical Value                                                                                               | 0.935  |   | Detected Data Not Lognormal at 5% Significance Level |        |                             |   |   |   |   |   |
| 4322 | Lilliefors Test Statistic                                                                                                    | 0.204  |   | <b>Lilliefors GOF Test</b>                           |        |                             |   |   |   |   |   |
| 4323 | 5% Lilliefors Critical Value                                                                                                 | 0.145  |   | Detected Data Not Lognormal at 5% Significance Level |        |                             |   |   |   |   |   |
| 4324 | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                                  |        |   |                                                      |        |                             |   |   |   |   |   |
| 4325 |                                                                                                                              |        |   |                                                      |        |                             |   |   |   |   |   |
| 4326 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                    |        |   |                                                      |        |                             |   |   |   |   |   |
| 4327 | Mean in Original Scale                                                                                                       | 0.373  |   | Mean in Log Scale                                    | -1.236 |                             |   |   |   |   |   |
| 4328 | SD in Original Scale                                                                                                         | 0.273  |   | SD in Log Scale                                      | 0.726  |                             |   |   |   |   |   |
| 4329 | 95% t UCL (assumes normality of ROS data)                                                                                    | 0.414  |   | 95% Percentile Bootstrap UCL                         | 0.415  |                             |   |   |   |   |   |
| 4330 | 95% BCA Bootstrap UCL                                                                                                        | 0.414  |   | 95% Bootstrap t UCL                                  | 0.416  |                             |   |   |   |   |   |
| 4331 | 95% H-UCL (Log ROS)                                                                                                          | 0.43   |   |                                                      |        |                             |   |   |   |   |   |
| 4332 |                                                                                                                              |        |   |                                                      |        |                             |   |   |   |   |   |
| 4333 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                      |        |   |                                                      |        |                             |   |   |   |   |   |
| 4334 | KM Mean (logged)                                                                                                             | -1.199 |   | KM Geo Mean                                          | 0.301  |                             |   |   |   |   |   |
| 4335 | KM SD (logged)                                                                                                               | 0.783  |   | 95% Critical H Value (KM-Log)                        | 2.009  |                             |   |   |   |   |   |
| 4336 | KM Standard Error of Mean (logged)                                                                                           | 0.202  |   | 95% H-UCL (KM -Log)                                  | 0.472  |                             |   |   |   |   |   |
| 4337 | KM SD (logged)                                                                                                               | 0.783  |   | 95% Critical H Value (KM-Log)                        | 2.009  |                             |   |   |   |   |   |
| 4338 | KM Standard Error of Mean (logged)                                                                                           | 0.202  |   |                                                      |        |                             |   |   |   |   |   |
| 4339 |                                                                                                                              |        |   |                                                      |        |                             |   |   |   |   |   |
| 4340 | <b>DL/2 Statistics</b>                                                                                                       |        |   |                                                      |        |                             |   |   |   |   |   |
| 4341 | <b>DL/2 Normal</b>                                                                                                           |        |   |                                                      |        | <b>DL/2 Log-Transformed</b> |   |   |   |   |   |
| 4342 | Mean in Original Scale                                                                                                       | 0.376  |   | Mean in Log Scale                                    | -1.135 |                             |   |   |   |   |   |
| 4343 | SD in Original Scale                                                                                                         | 0.254  |   | SD in Log Scale                                      | 0.516  |                             |   |   |   |   |   |
| 4344 | 95% t UCL (Assumes normality)                                                                                                | 0.413  |   | 95% H-Stat UCL                                       | 0.399  |                             |   |   |   |   |   |
| 4345 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                     |        |   |                                                      |        |                             |   |   |   |   |   |
| 4346 |                                                                                                                              |        |   |                                                      |        |                             |   |   |   |   |   |
| 4347 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                        |        |   |                                                      |        |                             |   |   |   |   |   |
| 4348 | <b>Detected Data appear Normal Distributed at 5% Significance Level</b>                                                      |        |   |                                                      |        |                             |   |   |   |   |   |
| 4349 |                                                                                                                              |        |   |                                                      |        |                             |   |   |   |   |   |
| 4350 | <b>Suggested UCL to Use</b>                                                                                                  |        |   |                                                      |        |                             |   |   |   |   |   |
| 4351 | 95% KM (t) UCL                                                                                                               | 0.471  |   |                                                      |        |                             |   |   |   |   |   |
| 4352 |                                                                                                                              |        |   |                                                      |        |                             |   |   |   |   |   |
| 4353 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. |        |   |                                                      |        |                             |   |   |   |   |   |
| 4354 | Recommendations are based upon data size, data distribution, and skewness.                                                   |        |   |                                                      |        |                             |   |   |   |   |   |
| 4355 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).     |        |   |                                                      |        |                             |   |   |   |   |   |

| A    | B                                                                                                                                        | C      | D                                                            | E | F      | G | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------------------------------------------------------|---|--------|---|---|---|---|---|---|
| 4356 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |                                                              |   |        |   |   |   |   |   |   |
| 4357 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 4358 | <b>Result (eu9_copper)</b>                                                                                                               |        |                                                              |   |        |   |   |   |   |   |   |
| 4359 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 4360 | <b>General Statistics</b>                                                                                                                |        |                                                              |   |        |   |   |   |   |   |   |
| 4361 | Total Number of Observations                                                                                                             | 216    | Number of Distinct Observations                              |   | 163    |   |   |   |   |   |   |
| 4362 | Number of Detects                                                                                                                        | 190    | Number of Non-Detects                                        |   | 26     |   |   |   |   |   |   |
| 4363 | Number of Distinct Detects                                                                                                               | 163    | Number of Distinct Non-Detects                               |   | 1      |   |   |   |   |   |   |
| 4364 | Minimum Detect                                                                                                                           | 2.1    | Minimum Non-Detect                                           |   | 2.5    |   |   |   |   |   |   |
| 4365 | Maximum Detect                                                                                                                           | 110    | Maximum Non-Detect                                           |   | 2.5    |   |   |   |   |   |   |
| 4366 | Variance Detects                                                                                                                         | 194.9  | Percent Non-Detects                                          |   | 12.04% |   |   |   |   |   |   |
| 4367 | Mean Detects                                                                                                                             | 14.82  | SD Detects                                                   |   | 13.96  |   |   |   |   |   |   |
| 4368 | Median Detects                                                                                                                           | 11.55  | CV Detects                                                   |   | 0.942  |   |   |   |   |   |   |
| 4369 | Skewness Detects                                                                                                                         | 3.509  | Kurtosis Detects                                             |   | 16.43  |   |   |   |   |   |   |
| 4370 | Mean of Logged Detects                                                                                                                   | 2.42   | SD of Logged Detects                                         |   | 0.722  |   |   |   |   |   |   |
| 4371 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 4372 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |        |                                                              |   |        |   |   |   |   |   |   |
| 4373 | Shapiro Wilk Test Statistic                                                                                                              | 0.676  | <b>Normal GOF Test on Detected Observations Only</b>         |   |        |   |   |   |   |   |   |
| 4374 | 5% Shapiro Wilk P Value                                                                                                                  | 0      | Detected Data Not Normal at 5% Significance Level            |   |        |   |   |   |   |   |   |
| 4375 | Lilliefors Test Statistic                                                                                                                | 0.196  | <b>Lilliefors GOF Test</b>                                   |   |        |   |   |   |   |   |   |
| 4376 | 5% Lilliefors Critical Value                                                                                                             | 0.0647 | Detected Data Not Normal at 5% Significance Level            |   |        |   |   |   |   |   |   |
| 4377 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |        |                                                              |   |        |   |   |   |   |   |   |
| 4378 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 4379 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |        |                                                              |   |        |   |   |   |   |   |   |
| 4380 | KM Mean                                                                                                                                  | 13.31  | KM Standard Error of Mean                                    |   | 0.934  |   |   |   |   |   |   |
| 4381 | KM SD                                                                                                                                    | 13.69  | 95% KM (BCA) UCL                                             |   | 14.92  |   |   |   |   |   |   |
| 4382 | 95% KM (t) UCL                                                                                                                           | 14.85  | 95% KM (Percentile Bootstrap) UCL                            |   | 14.99  |   |   |   |   |   |   |
| 4383 | 95% KM (z) UCL                                                                                                                           | 14.85  | 95% KM Bootstrap t UCL                                       |   | 15.21  |   |   |   |   |   |   |
| 4384 | 90% KM Chebyshev UCL                                                                                                                     | 16.11  | 95% KM Chebyshev UCL                                         |   | 17.38  |   |   |   |   |   |   |
| 4385 | 97.5% KM Chebyshev UCL                                                                                                                   | 19.14  | 99% KM Chebyshev UCL                                         |   | 22.6   |   |   |   |   |   |   |
| 4386 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 4387 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |        |                                                              |   |        |   |   |   |   |   |   |
| 4388 | A-D Test Statistic                                                                                                                       | 2.466  | <b>Anderson-Darling GOF Test</b>                             |   |        |   |   |   |   |   |   |
| 4389 | 5% A-D Critical Value                                                                                                                    | 0.767  | Detected Data Not Gamma Distributed at 5% Significance Level |   |        |   |   |   |   |   |   |
| 4390 | K-S Test Statistic                                                                                                                       | 0.0884 | <b>Kolmogorov-Smimov GOF</b>                                 |   |        |   |   |   |   |   |   |
| 4391 | 5% K-S Critical Value                                                                                                                    | 0.0671 | Detected Data Not Gamma Distributed at 5% Significance Level |   |        |   |   |   |   |   |   |
| 4392 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                                      |        |                                                              |   |        |   |   |   |   |   |   |
| 4393 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 4394 | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |        |                                                              |   |        |   |   |   |   |   |   |
| 4395 | k hat (MLE)                                                                                                                              | 1.963  | k star (bias corrected MLE)                                  |   | 1.936  |   |   |   |   |   |   |
| 4396 | Theta hat (MLE)                                                                                                                          | 7.552  | Theta star (bias corrected MLE)                              |   | 7.659  |   |   |   |   |   |   |
| 4397 | nu hat (MLE)                                                                                                                             | 746    | nu star (bias corrected)                                     |   | 735.5  |   |   |   |   |   |   |
| 4398 | Mean (detects)                                                                                                                           | 14.82  |                                                              |   |        |   |   |   |   |   |   |
| 4399 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 4400 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |        |                                                              |   |        |   |   |   |   |   |   |
| 4401 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |        |                                                              |   |        |   |   |   |   |   |   |
| 4402 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |        |                                                              |   |        |   |   |   |   |   |   |
| 4403 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |        |                                                              |   |        |   |   |   |   |   |   |
| 4404 | This is especially true when the sample size is small.                                                                                   |        |                                                              |   |        |   |   |   |   |   |   |
| 4405 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |        |                                                              |   |        |   |   |   |   |   |   |
| 4406 | Minimum                                                                                                                                  | 0.01   | Mean                                                         |   | 13.04  |   |   |   |   |   |   |
| 4407 | Maximum                                                                                                                                  | 110    | Median                                                       |   | 10.65  |   |   |   |   |   |   |
| 4408 | SD                                                                                                                                       | 13.95  | CV                                                           |   | 1.07   |   |   |   |   |   |   |
| 4409 | k hat (MLE)                                                                                                                              | 0.619  | k star (bias corrected MLE)                                  |   | 0.614  |   |   |   |   |   |   |
| 4410 | Theta hat (MLE)                                                                                                                          | 21.06  | Theta star (bias corrected MLE)                              |   | 21.25  |   |   |   |   |   |   |
| 4411 | nu hat (MLE)                                                                                                                             | 267.5  | nu star (bias corrected)                                     |   | 265.1  |   |   |   |   |   |   |
| 4412 | Adjusted Level of Significance ( $\beta$ )                                                                                               | 0.0489 |                                                              |   |        |   |   |   |   |   |   |
| 4413 | Approximate Chi Square Value (265.09, $\alpha$ )                                                                                         | 228.4  | Adjusted Chi Square Value (265.09, $\beta$ )                 |   | 228.2  |   |   |   |   |   |   |
| 4414 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                                        | 15.14  | 95% Gamma Adjusted UCL (use when $n < 50$ )                  |   | 15.15  |   |   |   |   |   |   |
| 4415 |                                                                                                                                          |        |                                                              |   |        |   |   |   |   |   |   |
| 4416 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |        |                                                              |   |        |   |   |   |   |   |   |
| 4417 | Mean (KM)                                                                                                                                | 13.31  | SD (KM)                                                      |   | 13.69  |   |   |   |   |   |   |
| 4418 | Variance (KM)                                                                                                                            | 187.3  | SE of Mean (KM)                                              |   | 0.934  |   |   |   |   |   |   |
| 4419 | k hat (KM)                                                                                                                               | 0.946  | k star (KM)                                                  |   | 0.936  |   |   |   |   |   |   |
| 4420 | nu hat (KM)                                                                                                                              | 408.7  | nu star (KM)                                                 |   | 404.3  |   |   |   |   |   |   |
| 4421 | theta hat (KM)                                                                                                                           | 14.07  | theta star (KM)                                              |   | 14.22  |   |   |   |   |   |   |
| 4422 | 80% gamma percentile (KM)                                                                                                                | 21.53  | 90% gamma percentile (KM)                                    |   | 31.15  |   |   |   |   |   |   |

| A    | B                                                                                                                                        | C | D | E       | F                                                       | G                           | H | I      | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|---|---|---------|---------------------------------------------------------|-----------------------------|---|--------|---|---|---|
| 4423 | 95% gamma percentile (KM)                                                                                                                |   |   | 40.82   | 99% gamma percentile (KM)                               |                             |   | 63.39  |   |   |   |
| 4424 |                                                                                                                                          |   |   |         |                                                         |                             |   |        |   |   |   |
| 4425 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |   |   |         |                                                         |                             |   |        |   |   |   |
| 4426 | Approximate Chi Square Value (404.31, $\alpha$ )                                                                                         |   |   | 358.7   | Adjusted Chi Square Value (404.31, $\beta$ )            |                             |   | 358.4  |   |   |   |
| 4427 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                      |   |   | 15      | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )          |                             |   | 15.02  |   |   |   |
| 4428 |                                                                                                                                          |   |   |         |                                                         |                             |   |        |   |   |   |
| 4429 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |   |   |         |                                                         |                             |   |        |   |   |   |
| 4430 | Shapiro Wilk Approximate Test Statistic                                                                                                  |   |   | 0.976   | <b>Shapiro Wilk GOF Test</b>                            |                             |   |        |   |   |   |
| 4431 | 5% Shapiro Wilk P Value                                                                                                                  |   |   | 0.148   | Detected Data appear Lognormal at 5% Significance Level |                             |   |        |   |   |   |
| 4432 | Lilliefors Test Statistic                                                                                                                |   |   | 0.0514  | <b>Lilliefors GOF Test</b>                              |                             |   |        |   |   |   |
| 4433 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.0647  | Detected Data appear Lognormal at 5% Significance Level |                             |   |        |   |   |   |
| 4434 | <b>Detected Data appear Lognormal at 5% Significance Level</b>                                                                           |   |   |         |                                                         |                             |   |        |   |   |   |
| 4435 |                                                                                                                                          |   |   |         |                                                         |                             |   |        |   |   |   |
| 4436 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |   |   |         |                                                         |                             |   |        |   |   |   |
| 4437 | Mean in Original Scale                                                                                                                   |   |   | 13.33   | Mean in Log Scale                                       |                             |   | 2.229  |   |   |   |
| 4438 | SD in Original Scale                                                                                                                     |   |   | 13.7    | SD in Log Scale                                         |                             |   | 0.86   |   |   |   |
| 4439 | 95% t UCL (assumes normality of ROS data)                                                                                                |   |   | 14.87   | 95% Percentile Bootstrap UCL                            |                             |   | 14.96  |   |   |   |
| 4440 | 95% BCA Bootstrap UCL                                                                                                                    |   |   | 15.33   | 95% Bootstrap t UCL                                     |                             |   | 15.21  |   |   |   |
| 4441 | 95% H-UCL (Log ROS)                                                                                                                      |   |   | 15.16   |                                                         |                             |   |        |   |   |   |
| 4442 |                                                                                                                                          |   |   |         |                                                         |                             |   |        |   |   |   |
| 4443 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |   |   |         |                                                         |                             |   |        |   |   |   |
| 4444 | KM Mean (logged)                                                                                                                         |   |   | 2.226   | KM Geo Mean                                             |                             |   | 9.267  |   |   |   |
| 4445 | KM SD (logged)                                                                                                                           |   |   | 0.856   | 95% Critical H Value (KM-Log)                           |                             |   | 2.032  |   |   |   |
| 4446 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.0587  | 95% H-UCL (KM -Log)                                     |                             |   | 15.05  |   |   |   |
| 4447 | KM SD (logged)                                                                                                                           |   |   | 0.856   | 95% Critical H Value (KM-Log)                           |                             |   | 2.032  |   |   |   |
| 4448 | KM Standard Error of Mean (logged)                                                                                                       |   |   | 0.0587  |                                                         |                             |   |        |   |   |   |
| 4449 |                                                                                                                                          |   |   |         |                                                         |                             |   |        |   |   |   |
| 4450 | <b>DL/2 Statistics</b>                                                                                                                   |   |   |         |                                                         |                             |   |        |   |   |   |
| 4451 | <b>DL/2 Normal</b>                                                                                                                       |   |   |         |                                                         | <b>DL/2 Log-Transformed</b> |   |        |   |   |   |
| 4452 | Mean in Original Scale                                                                                                                   |   |   | 13.19   | Mean in Log Scale                                       |                             |   | 2.156  |   |   |   |
| 4453 | SD in Original Scale                                                                                                                     |   |   | 13.82   | SD in Log Scale                                         |                             |   | 0.986  |   |   |   |
| 4454 | 95% t UCL (Assumes normality)                                                                                                            |   |   | 14.74   | 95% H-Stat UCL                                          |                             |   | 16.21  |   |   |   |
| 4455 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |   |   |         |                                                         |                             |   |        |   |   |   |
| 4456 |                                                                                                                                          |   |   |         |                                                         |                             |   |        |   |   |   |
| 4457 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |   |   |         |                                                         |                             |   |        |   |   |   |
| 4458 | <b>Detected Data appear Lognormal Distributed at 5% Significance Level</b>                                                               |   |   |         |                                                         |                             |   |        |   |   |   |
| 4459 |                                                                                                                                          |   |   |         |                                                         |                             |   |        |   |   |   |
| 4460 | <b>Suggested UCL to Use</b>                                                                                                              |   |   |         |                                                         |                             |   |        |   |   |   |
| 4461 | KM H-UCL                                                                                                                                 |   |   | 15.05   |                                                         |                             |   |        |   |   |   |
| 4462 |                                                                                                                                          |   |   |         |                                                         |                             |   |        |   |   |   |
| 4463 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |   |   |         |                                                         |                             |   |        |   |   |   |
| 4464 | Recommendations are based upon data size, data distribution, and skewness.                                                               |   |   |         |                                                         |                             |   |        |   |   |   |
| 4465 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |   |   |         |                                                         |                             |   |        |   |   |   |
| 4466 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |   |   |         |                                                         |                             |   |        |   |   |   |
| 4467 |                                                                                                                                          |   |   |         |                                                         |                             |   |        |   |   |   |
| 4468 | <b>Result (eu9_iron)</b>                                                                                                                 |   |   |         |                                                         |                             |   |        |   |   |   |
| 4469 |                                                                                                                                          |   |   |         |                                                         |                             |   |        |   |   |   |
| 4470 | <b>General Statistics</b>                                                                                                                |   |   |         |                                                         |                             |   |        |   |   |   |
| 4471 | Total Number of Observations                                                                                                             |   |   | 213     | Number of Distinct Observations                         |                             |   | 132    |   |   |   |
| 4472 | Number of Detects                                                                                                                        |   |   | 153     | Number of Non-Detects                                   |                             |   | 60     |   |   |   |
| 4473 | Number of Distinct Detects                                                                                                               |   |   | 130     | Number of Distinct Non-Detects                          |                             |   | 2      |   |   |   |
| 4474 | Minimum Detect                                                                                                                           |   |   | 9       | Minimum Non-Detect                                      |                             |   | 2.1    |   |   |   |
| 4475 | Maximum Detect                                                                                                                           |   |   | 8690    | Maximum Non-Detect                                      |                             |   | 100    |   |   |   |
| 4476 | Variance Detects                                                                                                                         |   |   | 1157866 | Percent Non-Detects                                     |                             |   | 28.17% |   |   |   |
| 4477 | Mean Detects                                                                                                                             |   |   | 470.2   | SD Detects                                              |                             |   | 1076   |   |   |   |
| 4478 | Median Detects                                                                                                                           |   |   | 232     | CV Detects                                              |                             |   | 2.288  |   |   |   |
| 4479 | Skewness Detects                                                                                                                         |   |   | 5.918   | Kurtosis Detects                                        |                             |   | 36.8   |   |   |   |
| 4480 | Mean of Logged Detects                                                                                                                   |   |   | 5.589   | SD of Logged Detects                                    |                             |   | 0.831  |   |   |   |
| 4481 |                                                                                                                                          |   |   |         |                                                         |                             |   |        |   |   |   |
| 4482 | <b>Normal GOF Test on Detects Only</b>                                                                                                   |   |   |         |                                                         |                             |   |        |   |   |   |
| 4483 | Shapiro Wilk Test Statistic                                                                                                              |   |   | 0.306   | <b>Normal GOF Test on Detected Observations Only</b>    |                             |   |        |   |   |   |
| 4484 | 5% Shapiro Wilk P Value                                                                                                                  |   |   | 0       | Detected Data Not Normal at 5% Significance Level       |                             |   |        |   |   |   |
| 4485 | Lilliefors Test Statistic                                                                                                                |   |   | 0.378   | <b>Lilliefors GOF Test</b>                              |                             |   |        |   |   |   |
| 4486 | 5% Lilliefors Critical Value                                                                                                             |   |   | 0.072   | Detected Data Not Normal at 5% Significance Level       |                             |   |        |   |   |   |
| 4487 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |   |   |         |                                                         |                             |   |        |   |   |   |
| 4488 |                                                                                                                                          |   |   |         |                                                         |                             |   |        |   |   |   |
| 4489 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |   |   |         |                                                         |                             |   |        |   |   |   |

| A    | B | C | D | E                                                                                                                         | F      | G | H | I                                                            | J | K | L     |
|------|---|---|---|---------------------------------------------------------------------------------------------------------------------------|--------|---|---|--------------------------------------------------------------|---|---|-------|
| 4490 |   |   |   | KM Mean                                                                                                                   | 343.1  |   |   | KM Standard Error of Mean                                    |   |   | 64.1  |
| 4491 |   |   |   | KM SD                                                                                                                     | 931.5  |   |   | 95% KM (BCA) UCL                                             |   |   | 465.3 |
| 4492 |   |   |   | 95% KM (t) UCL                                                                                                            | 449    |   |   | 95% KM (Percentile Bootstrap) UCL                            |   |   | 461.5 |
| 4493 |   |   |   | 95% KM (z) UCL                                                                                                            | 448.5  |   |   | 95% KM Bootstrap t UCL                                       |   |   | 518.2 |
| 4494 |   |   |   | 90% KM Chebyshev UCL                                                                                                      | 535.4  |   |   | 95% KM Chebyshev UCL                                         |   |   | 622.5 |
| 4495 |   |   |   | 97.5% KM Chebyshev UCL                                                                                                    | 743.4  |   |   | 99% KM Chebyshev UCL                                         |   |   | 980.9 |
| 4496 |   |   |   | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |        |   |   |                                                              |   |   |       |
| 4497 |   |   |   | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |        |   |   |                                                              |   |   |       |
| 4498 |   |   |   | A-D Test Statistic                                                                                                        | 14.56  |   |   | <b>Anderson-Darling GOF Test</b>                             |   |   |       |
| 4499 |   |   |   | 5% A-D Critical Value                                                                                                     | 0.783  |   |   | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |       |
| 4500 |   |   |   | K-S Test Statistic                                                                                                        | 0.228  |   |   | <b>Kolmogorov-Smirnov GOF</b>                                |   |   |       |
| 4501 |   |   |   | 5% K-S Critical Value                                                                                                     | 0.078  |   |   | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |       |
| 4502 |   |   |   | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                       |        |   |   |                                                              |   |   |       |
| 4503 |   |   |   | <b>Gamma Statistics on Detected Data Only</b>                                                                             |        |   |   |                                                              |   |   |       |
| 4504 |   |   |   | <b>Gamma Statistics on Detected Data Only</b>                                                                             |        |   |   |                                                              |   |   |       |
| 4505 |   |   |   | k hat (MLE)                                                                                                               | 1.02   |   |   | k star (bias corrected MLE)                                  |   |   | 1.004 |
| 4506 |   |   |   | Theta hat (MLE)                                                                                                           | 461    |   |   | Theta star (bias corrected MLE)                              |   |   | 468.2 |
| 4507 |   |   |   | nu hat (MLE)                                                                                                              | 312.1  |   |   | nu star (bias corrected)                                     |   |   | 307.3 |
| 4508 |   |   |   | Mean (detects)                                                                                                            | 470.2  |   |   |                                                              |   |   |       |
| 4509 |   |   |   | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |        |   |   |                                                              |   |   |       |
| 4510 |   |   |   | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |        |   |   |                                                              |   |   |       |
| 4511 |   |   |   | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |        |   |   |                                                              |   |   |       |
| 4512 |   |   |   | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |        |   |   |                                                              |   |   |       |
| 4513 |   |   |   | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |        |   |   |                                                              |   |   |       |
| 4514 |   |   |   | This is especially true when the sample size is small.                                                                    |        |   |   |                                                              |   |   |       |
| 4515 |   |   |   | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |        |   |   |                                                              |   |   |       |
| 4516 |   |   |   | Minimum                                                                                                                   | 0.01   |   |   | Mean                                                         |   |   | 337.8 |
| 4517 |   |   |   | Maximum                                                                                                                   | 8690   |   |   | Median                                                       |   |   | 176   |
| 4518 |   |   |   | SD                                                                                                                        | 935.5  |   |   | CV                                                           |   |   | 2.769 |
| 4519 |   |   |   | k hat (MLE)                                                                                                               | 0.232  |   |   | k star (bias corrected MLE)                                  |   |   | 0.231 |
| 4520 |   |   |   | Theta hat (MLE)                                                                                                           | 1459   |   |   | Theta star (bias corrected MLE)                              |   |   | 1460  |
| 4521 |   |   |   | nu hat (MLE)                                                                                                              | 98.65  |   |   | nu star (bias corrected)                                     |   |   | 98.59 |
| 4522 |   |   |   | Adjusted Level of Significance ( $\beta$ )                                                                                | 0.0489 |   |   |                                                              |   |   |       |
| 4523 |   |   |   | Approximate Chi Square Value (98.59, $\alpha$ )                                                                           | 76.69  |   |   | Adjusted Chi Square Value (98.59, $\beta$ )                  |   |   | 76.56 |
| 4524 |   |   |   | 95% Gamma Approximate UCL (use when n>=50)                                                                                | 434.3  |   |   | 95% Gamma Adjusted UCL (use when n<50)                       |   |   | 435   |
| 4525 |   |   |   | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |        |   |   |                                                              |   |   |       |
| 4526 |   |   |   | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |        |   |   |                                                              |   |   |       |
| 4527 |   |   |   | Mean (KM)                                                                                                                 | 343.1  |   |   | SD (KM)                                                      |   |   | 931.5 |
| 4528 |   |   |   | Variance (KM)                                                                                                             | 867684 |   |   | SE of Mean (KM)                                              |   |   | 64.1  |
| 4529 |   |   |   | k hat (KM)                                                                                                                | 0.136  |   |   | k star (KM)                                                  |   |   | 0.137 |
| 4530 |   |   |   | nu hat (KM)                                                                                                               | 57.8   |   |   | nu star (KM)                                                 |   |   | 58.32 |
| 4531 |   |   |   | theta hat (KM)                                                                                                            | 2529   |   |   | theta star (KM)                                              |   |   | 2506  |
| 4532 |   |   |   | 80% gamma percentile (KM)                                                                                                 | 344.7  |   |   | 90% gamma percentile (KM)                                    |   |   | 1002  |
| 4533 |   |   |   | 95% gamma percentile (KM)                                                                                                 | 1920   |   |   | 99% gamma percentile (KM)                                    |   |   | 4636  |
| 4534 |   |   |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |        |   |   |                                                              |   |   |       |
| 4535 |   |   |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |        |   |   |                                                              |   |   |       |
| 4536 |   |   |   | Approximate Chi Square Value (58.32, $\alpha$ )                                                                           | 41.76  |   |   | Adjusted Chi Square Value (58.32, $\beta$ )                  |   |   | 41.67 |
| 4537 |   |   |   | 5% Gamma Approximate KM-UCL (use when n>=50)                                                                              | 479.1  |   |   | 95% Gamma Adjusted KM-UCL (use when n<50)                    |   |   | 480.2 |
| 4538 |   |   |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |        |   |   |                                                              |   |   |       |
| 4539 |   |   |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |        |   |   |                                                              |   |   |       |
| 4540 |   |   |   | Shapiro Wilk Approximate Test Statistic                                                                                   | 0.886  |   |   | <b>Shapiro Wilk GOF Test</b>                                 |   |   |       |
| 4541 |   |   |   | 5% Shapiro Wilk P Value                                                                                                   | 0      |   |   | Detected Data Not Lognormal at 5% Significance Level         |   |   |       |
| 4542 |   |   |   | Lilliefors Test Statistic                                                                                                 | 0.107  |   |   | <b>Lilliefors GOF Test</b>                                   |   |   |       |
| 4543 |   |   |   | 5% Lilliefors Critical Value                                                                                              | 0.072  |   |   | Detected Data Not Lognormal at 5% Significance Level         |   |   |       |
| 4544 |   |   |   | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                               |        |   |   |                                                              |   |   |       |
| 4545 |   |   |   | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |        |   |   |                                                              |   |   |       |
| 4546 |   |   |   | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                 |        |   |   |                                                              |   |   |       |
| 4547 |   |   |   | Mean in Original Scale                                                                                                    | 351.7  |   |   | Mean in Log Scale                                            |   |   | 5.081 |
| 4548 |   |   |   | SD in Original Scale                                                                                                      | 930.7  |   |   | SD in Log Scale                                              |   |   | 1.11  |
| 4549 |   |   |   | 95% t UCL (assumes normality of ROS data)                                                                                 | 457.1  |   |   | 95% Percentile Bootstrap UCL                                 |   |   | 465.1 |
| 4550 |   |   |   | 95% BCA Bootstrap UCL                                                                                                     | 500.4  |   |   | 95% Bootstrap t UCL                                          |   |   | 520.5 |
| 4551 |   |   |   | 95% H-UCL (Log ROS)                                                                                                       | 353.4  |   |   |                                                              |   |   |       |
| 4552 |   |   |   | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |        |   |   |                                                              |   |   |       |
| 4553 |   |   |   | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                   |        |   |   |                                                              |   |   |       |
| 4554 |   |   |   | KM Mean (logged)                                                                                                          | 4.531  |   |   | KM Geo Mean                                                  |   |   | 92.84 |
| 4555 |   |   |   | KM SD (logged)                                                                                                            | 1.986  |   |   | 95% Critical H Value (KM-Log)                                |   |   | 3.14  |
| 4556 |   |   |   | KM Standard Error of Mean (logged)                                                                                        | 0.207  |   |   | 95% H-UCL (KM -Log)                                          |   |   | 1023  |

| A    | B | C | D | E | F                                                                                                                                        | G      | H | I                           | J | K                                                            | L      |
|------|---|---|---|---|------------------------------------------------------------------------------------------------------------------------------------------|--------|---|-----------------------------|---|--------------------------------------------------------------|--------|
| 4557 |   |   |   |   | KM SD (logged)                                                                                                                           | 1.986  |   |                             |   | 95% Critical H Value (KM-Log)                                | 3.14   |
| 4558 |   |   |   |   | KM Standard Error of Mean (logged)                                                                                                       | 0.207  |   |                             |   |                                                              |        |
| 4559 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                              |        |
| 4560 |   |   |   |   | <b>DL/2 Statistics</b>                                                                                                                   |        |   |                             |   |                                                              |        |
| 4561 |   |   |   |   | <b>DL/2 Normal</b>                                                                                                                       |        |   | <b>DL/2 Log-Transformed</b> |   |                                                              |        |
| 4562 |   |   |   |   | Mean in Original Scale                                                                                                                   | 350.9  |   |                             |   | Mean in Log Scale                                            | 5.044  |
| 4563 |   |   |   |   | SD in Original Scale                                                                                                                     | 931    |   |                             |   | SD in Log Scale                                              | 1.232  |
| 4564 |   |   |   |   | 95% t UCL (Assumes normality)                                                                                                            | 456.3  |   |                             |   | 95% H-Stat UCL                                               | 404.2  |
| 4565 |   |   |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |        |   |                             |   |                                                              |        |
| 4566 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                              |        |
| 4567 |   |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |   |                             |   |                                                              |        |
| 4568 |   |   |   |   | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                            |        |   |                             |   |                                                              |        |
| 4569 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                              |        |
| 4570 |   |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |        |   |                             |   |                                                              |        |
| 4571 |   |   |   |   | 95% KM (Chebyshev) UCL                                                                                                                   | 622.5  |   |                             |   |                                                              |        |
| 4572 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                              |        |
| 4573 |   |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |   |                             |   |                                                              |        |
| 4574 |   |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |   |                             |   |                                                              |        |
| 4575 |   |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |   |                             |   |                                                              |        |
| 4576 |   |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |   |                             |   |                                                              |        |
| 4577 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                              |        |
| 4578 |   |   |   |   | <b>Result (eu9_lead)</b>                                                                                                                 |        |   |                             |   |                                                              |        |
| 4579 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                              |        |
| 4580 |   |   |   |   | <b>General Statistics</b>                                                                                                                |        |   |                             |   |                                                              |        |
| 4581 |   |   |   |   | Total Number of Observations                                                                                                             | 216    |   |                             |   | Number of Distinct Observations                              | 188    |
| 4582 |   |   |   |   | Number of Detects                                                                                                                        | 208    |   |                             |   | Number of Non-Detects                                        | 8      |
| 4583 |   |   |   |   | Number of Distinct Detects                                                                                                               | 185    |   |                             |   | Number of Distinct Non-Detects                               | 3      |
| 4584 |   |   |   |   | Minimum Detect                                                                                                                           | 0.513  |   |                             |   | Minimum Non-Detect                                           | 0.03   |
| 4585 |   |   |   |   | Maximum Detect                                                                                                                           | 58.2   |   |                             |   | Maximum Non-Detect                                           | 0.5    |
| 4586 |   |   |   |   | Variance Detects                                                                                                                         | 72.96  |   |                             |   | Percent Non-Detects                                          | 3.704% |
| 4587 |   |   |   |   | Mean Detects                                                                                                                             | 6.528  |   |                             |   | SD Detects                                                   | 8.542  |
| 4588 |   |   |   |   | Median Detects                                                                                                                           | 2.775  |   |                             |   | CV Detects                                                   | 1.308  |
| 4589 |   |   |   |   | Skewness Detects                                                                                                                         | 2.579  |   |                             |   | Kurtosis Detects                                             | 8.635  |
| 4590 |   |   |   |   | Mean of Logged Detects                                                                                                                   | 1.25   |   |                             |   | SD of Logged Detects                                         | 1.085  |
| 4591 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                              |        |
| 4592 |   |   |   |   | <b>Normal GOF Test on Detects Only</b>                                                                                                   |        |   |                             |   |                                                              |        |
| 4593 |   |   |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.684  |   |                             |   | <b>Normal GOF Test on Detected Observations Only</b>         |        |
| 4594 |   |   |   |   | 5% Shapiro Wilk P Value                                                                                                                  | 0      |   |                             |   | Detected Data Not Normal at 5% Significance Level            |        |
| 4595 |   |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.241  |   |                             |   | <b>Lilliefors GOF Test</b>                                   |        |
| 4596 |   |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.0619 |   |                             |   | Detected Data Not Normal at 5% Significance Level            |        |
| 4597 |   |   |   |   | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                 |        |   |                             |   |                                                              |        |
| 4598 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                              |        |
| 4599 |   |   |   |   | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                            |        |   |                             |   |                                                              |        |
| 4600 |   |   |   |   | KM Mean                                                                                                                                  | 6.287  |   |                             |   | KM Standard Error of Mean                                    | 0.576  |
| 4601 |   |   |   |   | KM SD                                                                                                                                    | 8.451  |   |                             |   | 95% KM (BCA) UCL                                             | 7.22   |
| 4602 |   |   |   |   | 95% KM (t) UCL                                                                                                                           | 7.24   |   |                             |   | 95% KM (Percentile Bootstrap) UCL                            | 7.218  |
| 4603 |   |   |   |   | 95% KM (z) UCL                                                                                                                           | 7.235  |   |                             |   | 95% KM Bootstrap t UCL                                       | 7.338  |
| 4604 |   |   |   |   | 90% KM Chebyshev UCL                                                                                                                     | 8.017  |   |                             |   | 95% KM Chebyshev UCL                                         | 8.8    |
| 4605 |   |   |   |   | 97.5% KM Chebyshev UCL                                                                                                                   | 9.887  |   |                             |   | 99% KM Chebyshev UCL                                         | 12.02  |
| 4606 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                              |        |
| 4607 |   |   |   |   | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                     |        |   |                             |   |                                                              |        |
| 4608 |   |   |   |   | A-D Test Statistic                                                                                                                       | 7.81   |   |                             |   | <b>Anderson-Darling GOF Test</b>                             |        |
| 4609 |   |   |   |   | 5% A-D Critical Value                                                                                                                    | 0.787  |   |                             |   | Detected Data Not Gamma Distributed at 5% Significance Level |        |
| 4610 |   |   |   |   | K-S Test Statistic                                                                                                                       | 0.166  |   |                             |   | <b>Kolmogorov-Smirnov GOF</b>                                |        |
| 4611 |   |   |   |   | 5% K-S Critical Value                                                                                                                    | 0.0647 |   |                             |   | Detected Data Not Gamma Distributed at 5% Significance Level |        |
| 4612 |   |   |   |   | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                                      |        |   |                             |   |                                                              |        |
| 4613 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                              |        |
| 4614 |   |   |   |   | <b>Gamma Statistics on Detected Data Only</b>                                                                                            |        |   |                             |   |                                                              |        |
| 4615 |   |   |   |   | k hat (MLE)                                                                                                                              | 0.93   |   |                             |   | k star (bias corrected MLE)                                  | 0.92   |
| 4616 |   |   |   |   | Theta hat (MLE)                                                                                                                          | 7.016  |   |                             |   | Theta star (bias corrected MLE)                              | 7.094  |
| 4617 |   |   |   |   | nu hat (MLE)                                                                                                                             | 387    |   |                             |   | nu star (bias corrected)                                     | 382.8  |
| 4618 |   |   |   |   | Mean (detects)                                                                                                                           | 6.528  |   |                             |   |                                                              |        |
| 4619 |   |   |   |   |                                                                                                                                          |        |   |                             |   |                                                              |        |
| 4620 |   |   |   |   | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                    |        |   |                             |   |                                                              |        |
| 4621 |   |   |   |   | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                             |        |   |                             |   |                                                              |        |
| 4622 |   |   |   |   | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                |        |   |                             |   |                                                              |        |
| 4623 |   |   |   |   | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                             |        |   |                             |   |                                                              |        |

| A    | B                                                                                                                                        | C         | D | E                                                    | F     | G                           | H | I | J | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|-----------|---|------------------------------------------------------|-------|-----------------------------|---|---|---|---|---|
| 4624 | This is especially true when the sample size is small.                                                                                   |           |   |                                                      |       |                             |   |   |   |   |   |
| 4625 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                              |           |   |                                                      |       |                             |   |   |   |   |   |
| 4626 | Minimum                                                                                                                                  | 0.01      |   | Mean                                                 | 6.287 |                             |   |   |   |   |   |
| 4627 | Maximum                                                                                                                                  | 58.2      |   | Median                                               | 2.715 |                             |   |   |   |   |   |
| 4628 | SD                                                                                                                                       | 8.471     |   | CV                                                   | 1.348 |                             |   |   |   |   |   |
| 4629 | k hat (MLE)                                                                                                                              | 0.744     |   | k star (bias corrected MLE)                          | 0.737 |                             |   |   |   |   |   |
| 4630 | Theta hat (MLE)                                                                                                                          | 8.445     |   | Theta star (bias corrected MLE)                      | 8.528 |                             |   |   |   |   |   |
| 4631 | nu hat (MLE)                                                                                                                             | 321.6     |   | nu star (bias corrected)                             | 318.5 |                             |   |   |   |   |   |
| 4632 | Adjusted Level of Significance ( $\beta$ )                                                                                               | 0.0489    |   |                                                      |       |                             |   |   |   |   |   |
| 4633 | Approximate Chi Square Value (318.46, $\alpha$ )                                                                                         | 278.1     |   | Adjusted Chi Square Value (318.46, $\beta$ )         | 277.9 |                             |   |   |   |   |   |
| 4634 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                                        | 7.198     |   | 95% Gamma Adjusted UCL (use when $n < 50$ )          | 7.205 |                             |   |   |   |   |   |
| 4635 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |
| 4636 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |           |   |                                                      |       |                             |   |   |   |   |   |
| 4637 | Mean (KM)                                                                                                                                | 6.287     |   | SD (KM)                                              | 8.451 |                             |   |   |   |   |   |
| 4638 | Variance (KM)                                                                                                                            | 71.42     |   | SE of Mean (KM)                                      | 0.576 |                             |   |   |   |   |   |
| 4639 | k hat (KM)                                                                                                                               | 0.553     |   | k star (KM)                                          | 0.549 |                             |   |   |   |   |   |
| 4640 | nu hat (KM)                                                                                                                              | 239.1     |   | nu star (KM)                                         | 237.1 |                             |   |   |   |   |   |
| 4641 | theta hat (KM)                                                                                                                           | 11.36     |   | theta star (KM)                                      | 11.46 |                             |   |   |   |   |   |
| 4642 | 80% gamma percentile (KM)                                                                                                                | 10.36     |   | 90% gamma percentile (KM)                            | 16.68 |                             |   |   |   |   |   |
| 4643 | 95% gamma percentile (KM)                                                                                                                | 23.36     |   | 99% gamma percentile (KM)                            | 39.65 |                             |   |   |   |   |   |
| 4644 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |
| 4645 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |           |   |                                                      |       |                             |   |   |   |   |   |
| 4646 | Approximate Chi Square Value (237.11, $\alpha$ )                                                                                         | 202.5     |   | Adjusted Chi Square Value (237.11, $\beta$ )         | 202.2 |                             |   |   |   |   |   |
| 4647 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                      | 7.363     |   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )       | 7.371 |                             |   |   |   |   |   |
| 4648 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |
| 4649 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |           |   |                                                      |       |                             |   |   |   |   |   |
| 4650 | Shapiro Wilk Approximate Test Statistic                                                                                                  | 0.94      |   | <b>Shapiro Wilk GOF Test</b>                         |       |                             |   |   |   |   |   |
| 4651 | 5% Shapiro Wilk P Value                                                                                                                  | 7.069E-10 |   | Detected Data Not Lognormal at 5% Significance Level |       |                             |   |   |   |   |   |
| 4652 | Lilliefors Test Statistic                                                                                                                | 0.0988    |   | <b>Lilliefors GOF Test</b>                           |       |                             |   |   |   |   |   |
| 4653 | 5% Lilliefors Critical Value                                                                                                             | 0.0619    |   | Detected Data Not Lognormal at 5% Significance Level |       |                             |   |   |   |   |   |
| 4654 | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                                              |           |   |                                                      |       |                             |   |   |   |   |   |
| 4655 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |
| 4656 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |           |   |                                                      |       |                             |   |   |   |   |   |
| 4657 | Mean in Original Scale                                                                                                                   | 6.296     |   | Mean in Log Scale                                    | 1.153 |                             |   |   |   |   |   |
| 4658 | SD in Original Scale                                                                                                                     | 8.465     |   | SD in Log Scale                                      | 1.175 |                             |   |   |   |   |   |
| 4659 | 95% t UCL (assumes normality of ROS data)                                                                                                | 7.247     |   | 95% Percentile Bootstrap UCL                         | 7.258 |                             |   |   |   |   |   |
| 4660 | 95% BCA Bootstrap UCL                                                                                                                    | 7.356     |   | 95% Bootstrap t UCL                                  | 7.351 |                             |   |   |   |   |   |
| 4661 | 95% H-UCL (Log ROS)                                                                                                                      | 7.602     |   |                                                      |       |                             |   |   |   |   |   |
| 4662 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |
| 4663 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |           |   |                                                      |       |                             |   |   |   |   |   |
| 4664 | KM Mean (logged)                                                                                                                         | 1.074     |   | KM Geo Mean                                          | 2.927 |                             |   |   |   |   |   |
| 4665 | KM SD (logged)                                                                                                                           | 1.391     |   | 95% Critical H Value (KM-Log)                        | 2.506 |                             |   |   |   |   |   |
| 4666 | KM Standard Error of Mean (logged)                                                                                                       | 0.0949    |   | 95% H-UCL (KM -Log)                                  | 9.777 |                             |   |   |   |   |   |
| 4667 | KM SD (logged)                                                                                                                           | 1.391     |   | 95% Critical H Value (KM-Log)                        | 2.506 |                             |   |   |   |   |   |
| 4668 | KM Standard Error of Mean (logged)                                                                                                       | 0.0949    |   |                                                      |       |                             |   |   |   |   |   |
| 4669 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |
| 4670 | <b>DL/2 Statistics</b>                                                                                                                   |           |   |                                                      |       |                             |   |   |   |   |   |
| 4671 | <b>DL/2 Normal</b>                                                                                                                       |           |   |                                                      |       | <b>DL/2 Log-Transformed</b> |   |   |   |   |   |
| 4672 | Mean in Original Scale                                                                                                                   | 6.292     |   | Mean in Log Scale                                    | 1.116 |                             |   |   |   |   |   |
| 4673 | SD in Original Scale                                                                                                                     | 8.467     |   | SD in Log Scale                                      | 1.293 |                             |   |   |   |   |   |
| 4674 | 95% t UCL (Assumes normality)                                                                                                            | 7.244     |   | 95% H-Stat UCL                                       | 8.704 |                             |   |   |   |   |   |
| 4675 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |           |   |                                                      |       |                             |   |   |   |   |   |
| 4676 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |
| 4677 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |           |   |                                                      |       |                             |   |   |   |   |   |
| 4678 | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                            |           |   |                                                      |       |                             |   |   |   |   |   |
| 4679 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |
| 4680 | <b>Suggested UCL to Use</b>                                                                                                              |           |   |                                                      |       |                             |   |   |   |   |   |
| 4681 | 95% KM (Chebyshev) UCL                                                                                                                   | 8.8       |   |                                                      |       |                             |   |   |   |   |   |
| 4682 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |
| 4683 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |           |   |                                                      |       |                             |   |   |   |   |   |
| 4684 | Recommendations are based upon data size, data distribution, and skewness.                                                               |           |   |                                                      |       |                             |   |   |   |   |   |
| 4685 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |           |   |                                                      |       |                             |   |   |   |   |   |
| 4686 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |           |   |                                                      |       |                             |   |   |   |   |   |
| 4687 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |
| 4688 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |
| 4689 | <b>Result (eu9_manganese)</b>                                                                                                            |           |   |                                                      |       |                             |   |   |   |   |   |
| 4690 |                                                                                                                                          |           |   |                                                      |       |                             |   |   |   |   |   |

| A    | B                                                           | C | D      | E | F                                                   | G | H     | I | J | K | L |
|------|-------------------------------------------------------------|---|--------|---|-----------------------------------------------------|---|-------|---|---|---|---|
| 4691 | <b>General Statistics</b>                                   |   |        |   |                                                     |   |       |   |   |   |   |
| 4692 | Total Number of Observations                                |   | 216    |   | Number of Distinct Observations                     |   | 188   |   |   |   |   |
| 4693 |                                                             |   |        |   | Number of Missing Observations                      |   | 0     |   |   |   |   |
| 4694 | Minimum                                                     |   | 2.12   |   | Mean                                                |   | 1111  |   |   |   |   |
| 4695 | Maximum                                                     |   | 33500  |   | Median                                              |   | 444.5 |   |   |   |   |
| 4696 | SD                                                          |   | 3598   |   | Std. Error of Mean                                  |   | 244.8 |   |   |   |   |
| 4697 | Coefficient of Variation                                    |   | 3.24   |   | Skewness                                            |   | 7.661 |   |   |   |   |
| 4698 |                                                             |   |        |   |                                                     |   |       |   |   |   |   |
| 4699 | <b>Normal GOF Test</b>                                      |   |        |   |                                                     |   |       |   |   |   |   |
| 4700 | Shapiro Wilk Test Statistic                                 |   | 0.232  |   | <b>Shapiro Wilk GOF Test</b>                        |   |       |   |   |   |   |
| 4701 | 5% Shapiro Wilk P Value                                     |   | 0      |   | Data Not Normal at 5% Significance Level            |   |       |   |   |   |   |
| 4702 | Lilliefors Test Statistic                                   |   | 0.379  |   | <b>Lilliefors GOF Test</b>                          |   |       |   |   |   |   |
| 4703 | 5% Lilliefors Critical Value                                |   | 0.0607 |   | Data Not Normal at 5% Significance Level            |   |       |   |   |   |   |
| 4704 | <b>Data Not Normal at 5% Significance Level</b>             |   |        |   |                                                     |   |       |   |   |   |   |
| 4705 |                                                             |   |        |   |                                                     |   |       |   |   |   |   |
| 4706 | <b>Assuming Normal Distribution</b>                         |   |        |   |                                                     |   |       |   |   |   |   |
| 4707 | <b>95% Normal UCL</b>                                       |   |        |   | <b>95% UCLs (Adjusted for Skewness)</b>             |   |       |   |   |   |   |
| 4708 | 95% Student's-t UCL                                         |   | 1515   |   | 95% Adjusted-CLT UCL (Chen-1995)                    |   | 1650  |   |   |   |   |
| 4709 |                                                             |   |        |   | 95% Modified-t UCL (Johnson-1978)                   |   | 1536  |   |   |   |   |
| 4710 |                                                             |   |        |   |                                                     |   |       |   |   |   |   |
| 4711 | <b>Gamma GOF Test</b>                                       |   |        |   |                                                     |   |       |   |   |   |   |
| 4712 | A-D Test Statistic                                          |   | 17.55  |   | <b>Anderson-Darling Gamma GOF Test</b>              |   |       |   |   |   |   |
| 4713 | 5% A-D Critical Value                                       |   | 0.802  |   | Data Not Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |
| 4714 | K-S Test Statistic                                          |   | 0.186  |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |   |       |   |   |   |   |
| 4715 | 5% K-S Critical Value                                       |   | 0.0646 |   | Data Not Gamma Distributed at 5% Significance Level |   |       |   |   |   |   |
| 4716 | <b>Data Not Gamma Distributed at 5% Significance Level</b>  |   |        |   |                                                     |   |       |   |   |   |   |
| 4717 |                                                             |   |        |   |                                                     |   |       |   |   |   |   |
| 4718 | <b>Gamma Statistics</b>                                     |   |        |   |                                                     |   |       |   |   |   |   |
| 4719 | k hat (MLE)                                                 |   | 0.689  |   | k star (bias corrected MLE)                         |   | 0.682 |   |   |   |   |
| 4720 | Theta hat (MLE)                                             |   | 1613   |   | Theta star (bias corrected MLE)                     |   | 1628  |   |   |   |   |
| 4721 | nu hat (MLE)                                                |   | 297.5  |   | nu star (bias corrected)                            |   | 294.7 |   |   |   |   |
| 4722 | MLE Mean (bias corrected)                                   |   | 1111   |   | MLE Sd (bias corrected)                             |   | 1345  |   |   |   |   |
| 4723 |                                                             |   |        |   | Approximate Chi Square Value (0.05)                 |   | 255.9 |   |   |   |   |
| 4724 | Adjusted Level of Significance                              |   | 0.0489 |   | Adjusted Chi Square Value                           |   | 255.7 |   |   |   |   |
| 4725 |                                                             |   |        |   |                                                     |   |       |   |   |   |   |
| 4726 | <b>Assuming Gamma Distribution</b>                          |   |        |   |                                                     |   |       |   |   |   |   |
| 4727 | 95% Approximate Gamma UCL (use when n>=50))                 |   | 1279   |   | 95% Adjusted Gamma UCL (use when n<50)              |   | 1280  |   |   |   |   |
| 4728 |                                                             |   |        |   |                                                     |   |       |   |   |   |   |
| 4729 | <b>Lognormal GOF Test</b>                                   |   |        |   |                                                     |   |       |   |   |   |   |
| 4730 | Shapiro Wilk Test Statistic                                 |   | 0.833  |   | <b>Shapiro Wilk Lognormal GOF Test</b>              |   |       |   |   |   |   |
| 4731 | 5% Shapiro Wilk P Value                                     |   | 0      |   | Data Not Lognormal at 5% Significance Level         |   |       |   |   |   |   |
| 4732 | Lilliefors Test Statistic                                   |   | 0.188  |   | <b>Lilliefors Lognormal GOF Test</b>                |   |       |   |   |   |   |
| 4733 | 5% Lilliefors Critical Value                                |   | 0.0607 |   | Data Not Lognormal at 5% Significance Level         |   |       |   |   |   |   |
| 4734 | <b>Data Not Lognormal at 5% Significance Level</b>          |   |        |   |                                                     |   |       |   |   |   |   |
| 4735 |                                                             |   |        |   |                                                     |   |       |   |   |   |   |
| 4736 | <b>Lognormal Statistics</b>                                 |   |        |   |                                                     |   |       |   |   |   |   |
| 4737 | Minimum of Logged Data                                      |   | 0.751  |   | Mean of logged Data                                 |   | 6.133 |   |   |   |   |
| 4738 | Maximum of Logged Data                                      |   | 10.42  |   | SD of logged Data                                   |   | 1.262 |   |   |   |   |
| 4739 |                                                             |   |        |   |                                                     |   |       |   |   |   |   |
| 4740 | <b>Assuming Lognormal Distribution</b>                      |   |        |   |                                                     |   |       |   |   |   |   |
| 4741 | 95% H-UCL                                                   |   | 1255   |   | 90% Chebyshev (MVUE) UCL                            |   | 1360  |   |   |   |   |
| 4742 | 95% Chebyshev (MVUE) UCL                                    |   | 1517   |   | 97.5% Chebyshev (MVUE) UCL                          |   | 1734  |   |   |   |   |
| 4743 | 99% Chebyshev (MVUE) UCL                                    |   | 2160   |   |                                                     |   |       |   |   |   |   |
| 4744 |                                                             |   |        |   |                                                     |   |       |   |   |   |   |
| 4745 | <b>Nonparametric Distribution Free UCL Statistics</b>       |   |        |   |                                                     |   |       |   |   |   |   |
| 4746 | <b>Data do not follow a Discernible Distribution (0.05)</b> |   |        |   |                                                     |   |       |   |   |   |   |
| 4747 |                                                             |   |        |   |                                                     |   |       |   |   |   |   |
| 4748 | <b>Nonparametric Distribution Free UCLs</b>                 |   |        |   |                                                     |   |       |   |   |   |   |
| 4749 | 95% CLT UCL                                                 |   | 1513   |   | 95% Jackknife UCL                                   |   | 1515  |   |   |   |   |
| 4750 | 95% Standard Bootstrap UCL                                  |   | 1508   |   | 95% Bootstrap-t UCL                                 |   | 1911  |   |   |   |   |
| 4751 | 95% Hall's Bootstrap UCL                                    |   | 1571   |   | 95% Percentile Bootstrap UCL                        |   | 1545  |   |   |   |   |
| 4752 | 95% BCA Bootstrap UCL                                       |   | 1674   |   |                                                     |   |       |   |   |   |   |
| 4753 | 90% Chebyshev (Mean, Sd) UCL                                |   | 1845   |   | 95% Chebyshev (Mean, Sd) UCL                        |   | 2178  |   |   |   |   |
| 4754 | 97.5% Chebyshev (Mean, Sd) UCL                              |   | 2639   |   | 99% Chebyshev (Mean, Sd) UCL                        |   | 3546  |   |   |   |   |
| 4755 |                                                             |   |        |   |                                                     |   |       |   |   |   |   |
| 4756 | <b>Suggested UCL to Use</b>                                 |   |        |   |                                                     |   |       |   |   |   |   |
| 4757 | 95% Chebyshev (Mean, Sd) UCL                                |   | 2178   |   |                                                     |   |       |   |   |   |   |

| A    | B                                                                                                                                        | C         | D | E | F | G                                       | H | I                                                   | J     | K | L |
|------|------------------------------------------------------------------------------------------------------------------------------------------|-----------|---|---|---|-----------------------------------------|---|-----------------------------------------------------|-------|---|---|
| 4758 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4759 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4760 | Recommendations are based upon data size, data distribution, and skewness.                                                               |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4761 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4762 | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4763 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4764 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4765 | <b>Result (eu9_strontium)</b>                                                                                                            |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4766 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4767 | <b>General Statistics</b>                                                                                                                |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4768 | Total Number of Observations                                                                                                             | 87        |   |   |   |                                         |   | Number of Distinct Observations                     | 77    |   |   |
| 4769 |                                                                                                                                          |           |   |   |   |                                         |   | Number of Missing Observations                      | 0     |   |   |
| 4770 | Minimum                                                                                                                                  | 94        |   |   |   |                                         |   | Mean                                                | 341.1 |   |   |
| 4771 | Maximum                                                                                                                                  | 901       |   |   |   |                                         |   | Median                                              | 337   |   |   |
| 4772 | SD                                                                                                                                       | 179.4     |   |   |   |                                         |   | Std. Error of Mean                                  | 19.23 |   |   |
| 4773 | Coefficient of Variation                                                                                                                 | 0.526     |   |   |   |                                         |   | Skewness                                            | 0.694 |   |   |
| 4774 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4775 | <b>Normal GOF Test</b>                                                                                                                   |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4776 | Shapiro Wilk Test Statistic                                                                                                              | 0.89      |   |   |   |                                         |   | <b>Shapiro Wilk GOF Test</b>                        |       |   |   |
| 4777 | 5% Shapiro Wilk P Value                                                                                                                  | 1.7414E-8 |   |   |   |                                         |   | Data Not Normal at 5% Significance Level            |       |   |   |
| 4778 | Lilliefors Test Statistic                                                                                                                | 0.187     |   |   |   |                                         |   | <b>Lilliefors GOF Test</b>                          |       |   |   |
| 4779 | 5% Lilliefors Critical Value                                                                                                             | 0.0951    |   |   |   |                                         |   | Data Not Normal at 5% Significance Level            |       |   |   |
| 4780 | <b>Data Not Normal at 5% Significance Level</b>                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4781 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4782 | <b>Assuming Normal Distribution</b>                                                                                                      |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4783 | <b>95% Normal UCL</b>                                                                                                                    |           |   |   |   | <b>95% UCLs (Adjusted for Skewness)</b> |   |                                                     |       |   |   |
| 4784 | 95% Student's-t UCL                                                                                                                      | 373.1     |   |   |   |                                         |   | 95% Adjusted-CLT UCL (Chen-1995)                    | 374.3 |   |   |
| 4785 |                                                                                                                                          |           |   |   |   |                                         |   | 95% Modified-t UCL (Johnson-1978)                   | 373.3 |   |   |
| 4786 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4787 | <b>Gamma GOF Test</b>                                                                                                                    |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4788 | A-D Test Statistic                                                                                                                       | 3.209     |   |   |   |                                         |   | <b>Anderson-Darling Gamma GOF Test</b>              |       |   |   |
| 4789 | 5% A-D Critical Value                                                                                                                    | 0.757     |   |   |   |                                         |   | Data Not Gamma Distributed at 5% Significance Level |       |   |   |
| 4790 | K-S Test Statistic                                                                                                                       | 0.186     |   |   |   |                                         |   | <b>Kolmogorov-Smirnov Gamma GOF Test</b>            |       |   |   |
| 4791 | 5% K-S Critical Value                                                                                                                    | 0.0964    |   |   |   |                                         |   | Data Not Gamma Distributed at 5% Significance Level |       |   |   |
| 4792 | <b>Data Not Gamma Distributed at 5% Significance Level</b>                                                                               |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4793 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4794 | <b>Gamma Statistics</b>                                                                                                                  |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4795 | k hat (MLE)                                                                                                                              | 3.579     |   |   |   |                                         |   | k star (bias corrected MLE)                         | 3.464 |   |   |
| 4796 | Theta hat (MLE)                                                                                                                          | 95.3      |   |   |   |                                         |   | Theta star (bias corrected MLE)                     | 98.48 |   |   |
| 4797 | nu hat (MLE)                                                                                                                             | 622.8     |   |   |   |                                         |   | nu star (bias corrected)                            | 602.7 |   |   |
| 4798 | MLE Mean (bias corrected)                                                                                                                | 341.1     |   |   |   |                                         |   | MLE Sd (bias corrected)                             | 183.3 |   |   |
| 4799 |                                                                                                                                          |           |   |   |   |                                         |   | Approximate Chi Square Value (0.05)                 | 546.7 |   |   |
| 4800 | Adjusted Level of Significance                                                                                                           | 0.0472    |   |   |   |                                         |   | Adjusted Chi Square Value                           | 545.8 |   |   |
| 4801 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4802 | <b>Assuming Gamma Distribution</b>                                                                                                       |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4803 | 95% Approximate Gamma UCL (use when n>=50))                                                                                              | 376       |   |   |   |                                         |   | 95% Adjusted Gamma UCL (use when n<50)              | 376.6 |   |   |
| 4804 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4805 | <b>Lognormal GOF Test</b>                                                                                                                |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4806 | Shapiro Wilk Test Statistic                                                                                                              | 0.904     |   |   |   |                                         |   | <b>Shapiro Wilk Lognormal GOF Test</b>              |       |   |   |
| 4807 | 5% Shapiro Wilk P Value                                                                                                                  | 3.8127E-7 |   |   |   |                                         |   | Data Not Lognormal at 5% Significance Level         |       |   |   |
| 4808 | Lilliefors Test Statistic                                                                                                                | 0.185     |   |   |   |                                         |   | <b>Lilliefors Lognormal GOF Test</b>                |       |   |   |
| 4809 | 5% Lilliefors Critical Value                                                                                                             | 0.0951    |   |   |   |                                         |   | Data Not Lognormal at 5% Significance Level         |       |   |   |
| 4810 | <b>Data Not Lognormal at 5% Significance Level</b>                                                                                       |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4811 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4812 | <b>Lognormal Statistics</b>                                                                                                              |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4813 | Minimum of Logged Data                                                                                                                   | 4.543     |   |   |   |                                         |   | Mean of logged Data                                 | 5.686 |   |   |
| 4814 | Maximum of Logged Data                                                                                                                   | 6.804     |   |   |   |                                         |   | SD of logged Data                                   | 0.559 |   |   |
| 4815 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4816 | <b>Assuming Lognormal Distribution</b>                                                                                                   |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4817 | 95% H-UCL                                                                                                                                | 385.9     |   |   |   |                                         |   | 90% Chebyshev (MVUE) UCL                            | 409.7 |   |   |
| 4818 | 95% Chebyshev (MVUE) UCL                                                                                                                 | 439.6     |   |   |   |                                         |   | 97.5% Chebyshev (MVUE) UCL                          | 481   |   |   |
| 4819 | 99% Chebyshev (MVUE) UCL                                                                                                                 | 562.5     |   |   |   |                                         |   |                                                     |       |   |   |
| 4820 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4821 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4822 | <b>Data do not follow a Discernible Distribution (0.05)</b>                                                                              |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4823 |                                                                                                                                          |           |   |   |   |                                         |   |                                                     |       |   |   |
| 4824 | <b>Nonparametric Distribution Free UCLs</b>                                                                                              |           |   |   |   |                                         |   |                                                     |       |   |   |

| A    | B                                                                                                                                         | C | D | E                              | F     | G | H | I | J | K                                                            | L      |
|------|-------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------------------------------|-------|---|---|---|---|--------------------------------------------------------------|--------|
| 4825 |                                                                                                                                           |   |   | 95% CLT UCL                    | 372.7 |   |   |   |   | 95% Jackknife UCL                                            | 373.1  |
| 4826 |                                                                                                                                           |   |   | 95% Standard Bootstrap UCL     | 373.3 |   |   |   |   | 95% Bootstrap-t UCL                                          | 376.2  |
| 4827 |                                                                                                                                           |   |   | 95% Hall's Bootstrap UCL       | 374.3 |   |   |   |   | 95% Percentile Bootstrap UCL                                 | 372.6  |
| 4828 |                                                                                                                                           |   |   | 95% BCA Bootstrap UCL          | 373.7 |   |   |   |   |                                                              |        |
| 4829 |                                                                                                                                           |   |   | 90% Chebyshev(Mean, Sd) UCL    | 398.8 |   |   |   |   | 95% Chebyshev(Mean, Sd) UCL                                  | 424.9  |
| 4830 |                                                                                                                                           |   |   | 97.5% Chebyshev(Mean, Sd) UCL  | 461.2 |   |   |   |   | 99% Chebyshev(Mean, Sd) UCL                                  | 532.5  |
| 4831 |                                                                                                                                           |   |   |                                |       |   |   |   |   |                                                              |        |
| 4832 | <b>Suggested UCL to Use</b>                                                                                                               |   |   |                                |       |   |   |   |   |                                                              |        |
| 4833 |                                                                                                                                           |   |   | 95% Chebyshev (Mean, Sd) UCL   | 424.9 |   |   |   |   |                                                              |        |
| 4834 |                                                                                                                                           |   |   |                                |       |   |   |   |   |                                                              |        |
| 4835 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |   |   |                                |       |   |   |   |   |                                                              |        |
| 4836 | Recommendations are based upon data size, data distribution, and skewness.                                                                |   |   |                                |       |   |   |   |   |                                                              |        |
| 4837 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |   |   |                                |       |   |   |   |   |                                                              |        |
| 4838 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |   |   |                                |       |   |   |   |   |                                                              |        |
| 4839 |                                                                                                                                           |   |   |                                |       |   |   |   |   |                                                              |        |
| 4840 | <b>Result (eu9_thallium)</b>                                                                                                              |   |   |                                |       |   |   |   |   |                                                              |        |
| 4841 |                                                                                                                                           |   |   |                                |       |   |   |   |   |                                                              |        |
| 4842 | <b>General Statistics</b>                                                                                                                 |   |   |                                |       |   |   |   |   |                                                              |        |
| 4843 |                                                                                                                                           |   |   | Total Number of Observations   | 213   |   |   |   |   | Number of Distinct Observations                              | 31     |
| 4844 |                                                                                                                                           |   |   | Number of Detects              | 27    |   |   |   |   | Number of Non-Detects                                        | 186    |
| 4845 |                                                                                                                                           |   |   | Number of Distinct Detects     | 27    |   |   |   |   | Number of Distinct Non-Detects                               | 4      |
| 4846 |                                                                                                                                           |   |   | Minimum Detect                 | 6.09  |   |   |   |   | Minimum Non-Detect                                           | 0.031  |
| 4847 |                                                                                                                                           |   |   | Maximum Detect                 | 28.3  |   |   |   |   | Maximum Non-Detect                                           | 5      |
| 4848 |                                                                                                                                           |   |   | Variance Detects               | 18.06 |   |   |   |   | Percent Non-Detects                                          | 87.32% |
| 4849 |                                                                                                                                           |   |   | Mean Detects                   | 9.973 |   |   |   |   | SD Detects                                                   | 4.25   |
| 4850 |                                                                                                                                           |   |   | Median Detects                 | 8.79  |   |   |   |   | CV Detects                                                   | 0.426  |
| 4851 |                                                                                                                                           |   |   | Skewness Detects               | 3.268 |   |   |   |   | Kurtosis Detects                                             | 13.56  |
| 4852 |                                                                                                                                           |   |   | Mean of Logged Detects         | 2.243 |   |   |   |   | SD of Logged Detects                                         | 0.316  |
| 4853 |                                                                                                                                           |   |   |                                |       |   |   |   |   |                                                              |        |
| 4854 | <b>Normal GOF Test on Detects Only</b>                                                                                                    |   |   |                                |       |   |   |   |   |                                                              |        |
| 4855 |                                                                                                                                           |   |   | Shapiro Wilk Test Statistic    | 0.665 |   |   |   |   | <b>Shapiro Wilk GOF Test</b>                                 |        |
| 4856 |                                                                                                                                           |   |   | 5% Shapiro Wilk Critical Value | 0.923 |   |   |   |   | Detected Data Not Normal at 5% Significance Level            |        |
| 4857 |                                                                                                                                           |   |   | Lilliefors Test Statistic      | 0.227 |   |   |   |   | <b>Lilliefors GOF Test</b>                                   |        |
| 4858 |                                                                                                                                           |   |   | 5% Lilliefors Critical Value   | 0.167 |   |   |   |   | Detected Data Not Normal at 5% Significance Level            |        |
| 4859 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                                  |   |   |                                |       |   |   |   |   |                                                              |        |
| 4860 |                                                                                                                                           |   |   |                                |       |   |   |   |   |                                                              |        |
| 4861 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                                             |   |   |                                |       |   |   |   |   |                                                              |        |
| 4862 |                                                                                                                                           |   |   | KM Mean                        | 1.291 |   |   |   |   | KM Standard Error of Mean                                    | 0.253  |
| 4863 |                                                                                                                                           |   |   | KM SD                          | 3.626 |   |   |   |   | 95% KM (BCA) UCL                                             | 1.705  |
| 4864 |                                                                                                                                           |   |   | 95% KM (t) UCL                 | 1.709 |   |   |   |   | 95% KM (Percentile Bootstrap) UCL                            | 1.738  |
| 4865 |                                                                                                                                           |   |   | 95% KM (z) UCL                 | 1.708 |   |   |   |   | 95% KM Bootstrap t UCL                                       | 1.818  |
| 4866 |                                                                                                                                           |   |   | 90% KM Chebyshev UCL           | 2.051 |   |   |   |   | 95% KM Chebyshev UCL                                         | 2.395  |
| 4867 |                                                                                                                                           |   |   | 97.5% KM Chebyshev UCL         | 2.872 |   |   |   |   | 99% KM Chebyshev UCL                                         | 3.81   |
| 4868 |                                                                                                                                           |   |   |                                |       |   |   |   |   |                                                              |        |
| 4869 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                                      |   |   |                                |       |   |   |   |   |                                                              |        |
| 4870 |                                                                                                                                           |   |   | A-D Test Statistic             | 1.21  |   |   |   |   | <b>Anderson-Darling GOF Test</b>                             |        |
| 4871 |                                                                                                                                           |   |   | 5% A-D Critical Value          | 0.744 |   |   |   |   | Detected Data Not Gamma Distributed at 5% Significance Level |        |
| 4872 |                                                                                                                                           |   |   | K-S Test Statistic             | 0.2   |   |   |   |   | <b>Kolmogorov-Smirnov GOF</b>                                |        |
| 4873 |                                                                                                                                           |   |   | 5% K-S Critical Value          | 0.168 |   |   |   |   | Detected Data Not Gamma Distributed at 5% Significance Level |        |
| 4874 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                                       |   |   |                                |       |   |   |   |   |                                                              |        |
| 4875 |                                                                                                                                           |   |   |                                |       |   |   |   |   |                                                              |        |
| 4876 | <b>Gamma Statistics on Detected Data Only</b>                                                                                             |   |   |                                |       |   |   |   |   |                                                              |        |
| 4877 |                                                                                                                                           |   |   | k hat (MLE)                    | 8.912 |   |   |   |   | k star (bias corrected MLE)                                  | 7.946  |
| 4878 |                                                                                                                                           |   |   | Theta hat (MLE)                | 1.119 |   |   |   |   | Theta star (bias corrected MLE)                              | 1.255  |
| 4879 |                                                                                                                                           |   |   | nu hat (MLE)                   | 481.2 |   |   |   |   | nu star (bias corrected)                                     | 429.1  |
| 4880 |                                                                                                                                           |   |   | Mean (detects)                 | 9.973 |   |   |   |   |                                                              |        |
| 4881 |                                                                                                                                           |   |   |                                |       |   |   |   |   |                                                              |        |
| 4882 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                                     |   |   |                                |       |   |   |   |   |                                                              |        |
| 4883 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                                              |   |   |                                |       |   |   |   |   |                                                              |        |
| 4884 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)                 |   |   |                                |       |   |   |   |   |                                                              |        |
| 4885 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                                              |   |   |                                |       |   |   |   |   |                                                              |        |
| 4886 | This is especially true when the sample size is small.                                                                                    |   |   |                                |       |   |   |   |   |                                                              |        |
| 4887 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates                               |   |   |                                |       |   |   |   |   |                                                              |        |
| 4888 |                                                                                                                                           |   |   | Minimum                        | 0.01  |   |   |   |   | Mean                                                         | 1.706  |
| 4889 |                                                                                                                                           |   |   | Maximum                        | 28.3  |   |   |   |   | Median                                                       | 0.01   |
| 4890 |                                                                                                                                           |   |   | SD                             | 3.66  |   |   |   |   | CV                                                           | 2.145  |
| 4891 |                                                                                                                                           |   |   | k hat (MLE)                    | 0.218 |   |   |   |   | k star (bias corrected MLE)                                  | 0.218  |

| A    | B | C | D | E                                                                                                                                        | F      | G | H | I                           | J                                                    | K | L     |
|------|---|---|---|------------------------------------------------------------------------------------------------------------------------------------------|--------|---|---|-----------------------------|------------------------------------------------------|---|-------|
| 4892 |   |   |   | Theta hat (MLE)                                                                                                                          | 7.817  |   |   |                             | Theta star (bias corrected MLE)                      |   | 7.815 |
| 4893 |   |   |   | nu hat (MLE)                                                                                                                             | 92.99  |   |   |                             | nu star (bias corrected)                             |   | 93.01 |
| 4894 |   |   |   | Adjusted Level of Significance ( $\beta$ )                                                                                               | 0.0489 |   |   |                             |                                                      |   |       |
| 4895 |   |   |   | Approximate Chi Square Value (93.01, $\alpha$ )                                                                                          | 71.77  |   |   |                             | Adjusted Chi Square Value (93.01, $\beta$ )          |   | 71.64 |
| 4896 |   |   |   | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                                        | 2.211  |   |   |                             | 95% Gamma Adjusted UCL (use when $n < 50$ )          |   | 2.215 |
| 4897 |   |   |   | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |        |   |   |                             |                                                      |   |       |
| 4898 |   |   |   | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                                  |        |   |   |                             |                                                      |   |       |
| 4899 |   |   |   | Mean (KM)                                                                                                                                | 1.291  |   |   |                             | SD (KM)                                              |   | 3.626 |
| 4900 |   |   |   | Variance (KM)                                                                                                                            | 13.15  |   |   |                             | SE of Mean (KM)                                      |   | 0.253 |
| 4901 |   |   |   | k hat (KM)                                                                                                                               | 0.127  |   |   |                             | k star (KM)                                          |   | 0.128 |
| 4902 |   |   |   | nu hat (KM)                                                                                                                              | 54.03  |   |   |                             | nu star (KM)                                         |   | 54.6  |
| 4903 |   |   |   | theta hat (KM)                                                                                                                           | 10.18  |   |   |                             | theta star (KM)                                      |   | 10.07 |
| 4904 |   |   |   | 80% gamma percentile (KM)                                                                                                                | 1.216  |   |   |                             | 90% gamma percentile (KM)                            |   | 3.72  |
| 4905 |   |   |   | 95% gamma percentile (KM)                                                                                                                | 7.302  |   |   |                             | 99% gamma percentile (KM)                            |   | 18.06 |
| 4906 |   |   |   |                                                                                                                                          |        |   |   |                             |                                                      |   |       |
| 4907 |   |   |   | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                                |        |   |   |                             |                                                      |   |       |
| 4908 |   |   |   | Approximate Chi Square Value (54.60, $\alpha$ )                                                                                          | 38.62  |   |   |                             | Adjusted Chi Square Value (54.60, $\beta$ )          |   | 38.53 |
| 4909 |   |   |   | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                                      | 1.825  |   |   |                             | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )       |   | 1.83  |
| 4910 |   |   |   |                                                                                                                                          |        |   |   |                             |                                                      |   |       |
| 4911 |   |   |   | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                                  |        |   |   |                             |                                                      |   |       |
| 4912 |   |   |   | Shapiro Wilk Test Statistic                                                                                                              | 0.877  |   |   |                             | <b>Shapiro Wilk GOF Test</b>                         |   |       |
| 4913 |   |   |   | 5% Shapiro Wilk Critical Value                                                                                                           | 0.923  |   |   |                             | Detected Data Not Lognormal at 5% Significance Level |   |       |
| 4914 |   |   |   | Lilliefors Test Statistic                                                                                                                | 0.179  |   |   |                             | <b>Lilliefors GOF Test</b>                           |   |       |
| 4915 |   |   |   | 5% Lilliefors Critical Value                                                                                                             | 0.167  |   |   |                             | Detected Data Not Lognormal at 5% Significance Level |   |       |
| 4916 |   |   |   | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                                              |        |   |   |                             |                                                      |   |       |
| 4917 |   |   |   |                                                                                                                                          |        |   |   |                             |                                                      |   |       |
| 4918 |   |   |   | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                |        |   |   |                             |                                                      |   |       |
| 4919 |   |   |   | Mean in Original Scale                                                                                                                   | 3.526  |   |   |                             | Mean in Log Scale                                    |   | 0.964 |
| 4920 |   |   |   | SD in Original Scale                                                                                                                     | 3.179  |   |   |                             | SD in Log Scale                                      |   | 0.767 |
| 4921 |   |   |   | 95% t UCL (assumes normality of ROS data)                                                                                                | 3.886  |   |   |                             | 95% Percentile Bootstrap UCL                         |   | 3.902 |
| 4922 |   |   |   | 95% BCA Bootstrap UCL                                                                                                                    | 3.955  |   |   |                             | 95% Bootstrap t UCL                                  |   | 3.959 |
| 4923 |   |   |   | 95% H-UCL (Log ROS)                                                                                                                      | 3.901  |   |   |                             |                                                      |   |       |
| 4924 |   |   |   |                                                                                                                                          |        |   |   |                             |                                                      |   |       |
| 4925 |   |   |   | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                  |        |   |   |                             |                                                      |   |       |
| 4926 |   |   |   | KM Mean (logged)                                                                                                                         | -2.749 |   |   |                             | KM Geo Mean                                          |   | 0.064 |
| 4927 |   |   |   | KM SD (logged)                                                                                                                           | 1.905  |   |   |                             | 95% Critical H Value (KM-Log)                        |   | 3.05  |
| 4928 |   |   |   | KM Standard Error of Mean (logged)                                                                                                       | 0.133  |   |   |                             | 95% H-UCL (KM -Log)                                  |   | 0.585 |
| 4929 |   |   |   | KM SD (logged)                                                                                                                           | 1.905  |   |   |                             | 95% Critical H Value (KM-Log)                        |   | 3.05  |
| 4930 |   |   |   | KM Standard Error of Mean (logged)                                                                                                       | 0.133  |   |   |                             |                                                      |   |       |
| 4931 |   |   |   |                                                                                                                                          |        |   |   |                             |                                                      |   |       |
| 4932 |   |   |   | <b>DL/2 Statistics</b>                                                                                                                   |        |   |   |                             |                                                      |   |       |
| 4933 |   |   |   | <b>DL/2 Normal</b>                                                                                                                       |        |   |   | <b>DL/2 Log-Transformed</b> |                                                      |   |       |
| 4934 |   |   |   | Mean in Original Scale                                                                                                                   | 2.996  |   |   |                             | Mean in Log Scale                                    |   | 0.663 |
| 4935 |   |   |   | SD in Original Scale                                                                                                                     | 3.129  |   |   |                             | SD in Log Scale                                      |   | 1.223 |
| 4936 |   |   |   | 95% t UCL (Assumes normality)                                                                                                            | 3.35   |   |   |                             | 95% H-Stat UCL                                       |   | 4.987 |
| 4937 |   |   |   | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                 |        |   |   |                             |                                                      |   |       |
| 4938 |   |   |   |                                                                                                                                          |        |   |   |                             |                                                      |   |       |
| 4939 |   |   |   | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                    |        |   |   |                             |                                                      |   |       |
| 4940 |   |   |   | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                            |        |   |   |                             |                                                      |   |       |
| 4941 |   |   |   |                                                                                                                                          |        |   |   |                             |                                                      |   |       |
| 4942 |   |   |   | <b>Suggested UCL to Use</b>                                                                                                              |        |   |   |                             |                                                      |   |       |
| 4943 |   |   |   | 95% KM (t) UCL                                                                                                                           | 1.709  |   |   |                             | KM H-UCL                                             |   | 0.585 |
| 4944 |   |   |   | 95% KM (BCA) UCL                                                                                                                         | 1.705  |   |   |                             |                                                      |   |       |
| 4945 |   |   |   |                                                                                                                                          |        |   |   |                             |                                                      |   |       |
| 4946 |   |   |   | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.             |        |   |   |                             |                                                      |   |       |
| 4947 |   |   |   | Recommendations are based upon data size, data distribution, and skewness.                                                               |        |   |   |                             |                                                      |   |       |
| 4948 |   |   |   | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                 |        |   |   |                             |                                                      |   |       |
| 4949 |   |   |   | however, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician |        |   |   |                             |                                                      |   |       |
| 4950 |   |   |   |                                                                                                                                          |        |   |   |                             |                                                      |   |       |
| 4951 |   |   |   | <b>Result (eu9_zinc)</b>                                                                                                                 |        |   |   |                             |                                                      |   |       |
| 4952 |   |   |   |                                                                                                                                          |        |   |   |                             |                                                      |   |       |
| 4953 |   |   |   | <b>General Statistics</b>                                                                                                                |        |   |   |                             |                                                      |   |       |
| 4954 |   |   |   | Total Number of Observations                                                                                                             | 216    |   |   |                             | Number of Distinct Observations                      |   | 168   |
| 4955 |   |   |   | Number of Detects                                                                                                                        | 215    |   |   |                             | Number of Non-Detects                                |   | 1     |
| 4956 |   |   |   | Number of Distinct Detects                                                                                                               | 167    |   |   |                             | Number of Distinct Non-Detects                       |   | 1     |
| 4957 |   |   |   | Minimum Detect                                                                                                                           | 10.5   |   |   |                             | Minimum Non-Detect                                   |   | 10    |
| 4958 |   |   |   | Maximum Detect                                                                                                                           | 13400  |   |   |                             | Maximum Non-Detect                                   |   | 10    |

|      | A                                                                                                                         | B | C | D       | E                                                            | F | G | H      | I | J | K | L |
|------|---------------------------------------------------------------------------------------------------------------------------|---|---|---------|--------------------------------------------------------------|---|---|--------|---|---|---|---|
| 4959 | Variance Detects                                                                                                          |   |   | 2185107 | Percent Non-Detects                                          |   |   | 0.4639 |   |   |   |   |
| 4960 | Mean Detects                                                                                                              |   |   | 590     | SD Detects                                                   |   |   | 1478   |   |   |   |   |
| 4961 | Median Detects                                                                                                            |   |   | 344     | CV Detects                                                   |   |   | 2.506  |   |   |   |   |
| 4962 | Skewness Detects                                                                                                          |   |   | 7.429   | Kurtosis Detects                                             |   |   | 56.56  |   |   |   |   |
| 4963 | Mean of Logged Detects                                                                                                    |   |   | 5.891   | SD of Logged Detects                                         |   |   | 0.811  |   |   |   |   |
| 4964 |                                                                                                                           |   |   |         |                                                              |   |   |        |   |   |   |   |
| 4965 | <b>Normal GOF Test on Detects Only</b>                                                                                    |   |   |         |                                                              |   |   |        |   |   |   |   |
| 4966 | Shapiro Wilk Test Statistic                                                                                               |   |   | 0.221   | <b>Normal GOF Test on Detected Observations Only</b>         |   |   |        |   |   |   |   |
| 4967 | 5% Shapiro Wilk P Value                                                                                                   |   |   | 0       | Detected Data Not Normal at 5% Significance Level            |   |   |        |   |   |   |   |
| 4968 | Lilliefors Test Statistic                                                                                                 |   |   | 0.397   | <b>Lilliefors GOF Test</b>                                   |   |   |        |   |   |   |   |
| 4969 | 5% Lilliefors Critical Value                                                                                              |   |   | 0.0608  | Detected Data Not Normal at 5% Significance Level            |   |   |        |   |   |   |   |
| 4970 | <b>Detected Data Not Normal at 5% Significance Level</b>                                                                  |   |   |         |                                                              |   |   |        |   |   |   |   |
| 4971 |                                                                                                                           |   |   |         |                                                              |   |   |        |   |   |   |   |
| 4972 | <b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>                             |   |   |         |                                                              |   |   |        |   |   |   |   |
| 4973 | KM Mean                                                                                                                   |   |   | 587.3   | KM Standard Error of Mean                                    |   |   | 100.4  |   |   |   |   |
| 4974 | KM SD                                                                                                                     |   |   | 1472    | 95% KM (BCA) UCL                                             |   |   | 782.1  |   |   |   |   |
| 4975 | 95% KM (t) UCL                                                                                                            |   |   | 753.1   | 95% KM (Percentile Bootstrap) UCL                            |   |   | 773.3  |   |   |   |   |
| 4976 | 95% KM (z) UCL                                                                                                            |   |   | 752.4   | 95% KM Bootstrap t UCL                                       |   |   | 891.6  |   |   |   |   |
| 4977 | 90% KM Chebyshev UCL                                                                                                      |   |   | 888.4   | 95% KM Chebyshev UCL                                         |   |   | 1025   |   |   |   |   |
| 4978 | 97.5% KM Chebyshev UCL                                                                                                    |   |   | 1214    | 99% KM Chebyshev UCL                                         |   |   | 1586   |   |   |   |   |
| 4979 |                                                                                                                           |   |   |         |                                                              |   |   |        |   |   |   |   |
| 4980 | <b>Gamma GOF Tests on Detected Observations Only</b>                                                                      |   |   |         |                                                              |   |   |        |   |   |   |   |
| 4981 | A-D Test Statistic                                                                                                        |   |   | 29.93   | <b>Anderson-Darling GOF Test</b>                             |   |   |        |   |   |   |   |
| 4982 | 5% A-D Critical Value                                                                                                     |   |   | 0.78    | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |        |   |   |   |   |
| 4983 | K-S Test Statistic                                                                                                        |   |   | 0.26    | <b>Kolmogorov-Smirnov GOF</b>                                |   |   |        |   |   |   |   |
| 4984 | 5% K-S Critical Value                                                                                                     |   |   | 0.0635  | Detected Data Not Gamma Distributed at 5% Significance Level |   |   |        |   |   |   |   |
| 4985 | <b>Detected Data Not Gamma Distributed at 5% Significance Level</b>                                                       |   |   |         |                                                              |   |   |        |   |   |   |   |
| 4986 |                                                                                                                           |   |   |         |                                                              |   |   |        |   |   |   |   |
| 4987 | <b>Gamma Statistics on Detected Data Only</b>                                                                             |   |   |         |                                                              |   |   |        |   |   |   |   |
| 4988 | k hat (MLE)                                                                                                               |   |   | 1.162   | k star (bias corrected MLE)                                  |   |   | 1.148  |   |   |   |   |
| 4989 | Theta hat (MLE)                                                                                                           |   |   | 507.9   | Theta star (bias corrected MLE)                              |   |   | 513.7  |   |   |   |   |
| 4990 | nu hat (MLE)                                                                                                              |   |   | 499.5   | nu star (bias corrected)                                     |   |   | 493.8  |   |   |   |   |
| 4991 | Mean (detects)                                                                                                            |   |   | 590     |                                                              |   |   |        |   |   |   |   |
| 4992 |                                                                                                                           |   |   |         |                                                              |   |   |        |   |   |   |   |
| 4993 | <b>Gamma ROS Statistics using Imputed Non-Detects</b>                                                                     |   |   |         |                                                              |   |   |        |   |   |   |   |
| 4994 | GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs                              |   |   |         |                                                              |   |   |        |   |   |   |   |
| 4995 | GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20) |   |   |         |                                                              |   |   |        |   |   |   |   |
| 4996 | For such situations, GROS method may yield incorrect values of UCLs and BTVs                                              |   |   |         |                                                              |   |   |        |   |   |   |   |
| 4997 | This is especially true when the sample size is small.                                                                    |   |   |         |                                                              |   |   |        |   |   |   |   |
| 4998 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates               |   |   |         |                                                              |   |   |        |   |   |   |   |
| 4999 | Minimum                                                                                                                   |   |   | 0.01    | Mean                                                         |   |   | 587.2  |   |   |   |   |
| 5000 | Maximum                                                                                                                   |   |   | 13400   | Median                                                       |   |   | 344    |   |   |   |   |
| 5001 | SD                                                                                                                        |   |   | 1475    | CV                                                           |   |   | 2.512  |   |   |   |   |
| 5002 | k hat (MLE)                                                                                                               |   |   | 1.075   | k star (bias corrected MLE)                                  |   |   | 1.063  |   |   |   |   |
| 5003 | Theta hat (MLE)                                                                                                           |   |   | 546.4   | Theta star (bias corrected MLE)                              |   |   | 552.5  |   |   |   |   |
| 5004 | nu hat (MLE)                                                                                                              |   |   | 464.3   | nu star (bias corrected)                                     |   |   | 459.2  |   |   |   |   |
| 5005 | Adjusted Level of Significance ( $\beta$ )                                                                                |   |   | 0.0489  |                                                              |   |   |        |   |   |   |   |
| 5006 | Approximate Chi Square Value (459.19, $\alpha$ )                                                                          |   |   | 410.5   | Adjusted Chi Square Value (459.19, $\beta$ )                 |   |   | 410.2  |   |   |   |   |
| 5007 | 95% Gamma Approximate UCL (use when $n \geq 50$ )                                                                         |   |   | 656.9   | 95% Gamma Adjusted UCL (use when $n < 50$ )                  |   |   | 657.4  |   |   |   |   |
| 5008 |                                                                                                                           |   |   |         |                                                              |   |   |        |   |   |   |   |
| 5009 | <b>Estimates of Gamma Parameters using KM Estimates</b>                                                                   |   |   |         |                                                              |   |   |        |   |   |   |   |
| 5010 | Mean (KM)                                                                                                                 |   |   | 587.3   | SD (KM)                                                      |   |   | 1472   |   |   |   |   |
| 5011 | Variance (KM)                                                                                                             |   |   | 2166424 | SE of Mean (KM)                                              |   |   | 100.4  |   |   |   |   |
| 5012 | k hat (KM)                                                                                                                |   |   | 0.159   | k star (KM)                                                  |   |   | 0.16   |   |   |   |   |
| 5013 | nu hat (KM)                                                                                                               |   |   | 68.78   | nu star (KM)                                                 |   |   | 69.16  |   |   |   |   |
| 5014 | theta hat (KM)                                                                                                            |   |   | 3689    | theta star (KM)                                              |   |   | 3669   |   |   |   |   |
| 5015 | 80% gamma percentile (KM)                                                                                                 |   |   | 672.7   | 90% gamma percentile (KM)                                    |   |   | 1755   |   |   |   |   |
| 5016 | 95% gamma percentile (KM)                                                                                                 |   |   | 3190    | 99% gamma percentile (KM)                                    |   |   | 7300   |   |   |   |   |
| 5017 |                                                                                                                           |   |   |         |                                                              |   |   |        |   |   |   |   |
| 5018 | <b>Gamma Kaplan-Meier (KM) Statistics</b>                                                                                 |   |   |         |                                                              |   |   |        |   |   |   |   |
| 5019 | Approximate Chi Square Value (69.16, $\alpha$ )                                                                           |   |   | 51.01   | Adjusted Chi Square Value (69.16, $\beta$ )                  |   |   | 50.91  |   |   |   |   |
| 5020 | 5% Gamma Approximate KM-UCL (use when $n \geq 50$ )                                                                       |   |   | 796.2   | 95% Gamma Adjusted KM-UCL (use when $n < 50$ )               |   |   | 797.8  |   |   |   |   |
| 5021 |                                                                                                                           |   |   |         |                                                              |   |   |        |   |   |   |   |
| 5022 | <b>Lognormal GOF Test on Detected Observations Only</b>                                                                   |   |   |         |                                                              |   |   |        |   |   |   |   |
| 5023 | Shapiro Wilk Approximate Test Statistic                                                                                   |   |   | 0.72    | <b>Shapiro Wilk GOF Test</b>                                 |   |   |        |   |   |   |   |
| 5024 | 5% Shapiro Wilk P Value                                                                                                   |   |   | 0       | Detected Data Not Lognormal at 5% Significance Level         |   |   |        |   |   |   |   |
| 5025 | Lilliefors Test Statistic                                                                                                 |   |   | 0.217   | <b>Lilliefors GOF Test</b>                                   |   |   |        |   |   |   |   |

|      | A                                                                                                                                         | B | C      | D                                                    | E | F     | G | H | I | J | K | L |
|------|-------------------------------------------------------------------------------------------------------------------------------------------|---|--------|------------------------------------------------------|---|-------|---|---|---|---|---|---|
| 5026 | 5% Lilliefors Critical Value                                                                                                              |   | 0.0608 | Detected Data Not Lognormal at 5% Significance Level |   |       |   |   |   |   |   |   |
| 5027 | <b>Detected Data Not Lognormal at 5% Significance Level</b>                                                                               |   |        |                                                      |   |       |   |   |   |   |   |   |
| 5028 |                                                                                                                                           |   |        |                                                      |   |       |   |   |   |   |   |   |
| 5029 | <b>Lognormal ROS Statistics Using Imputed Non-Detects</b>                                                                                 |   |        |                                                      |   |       |   |   |   |   |   |   |
| 5030 | Mean in Original Scale                                                                                                                    |   | 587.5  | Mean in Log Scale                                    |   | 5.882 |   |   |   |   |   |   |
| 5031 | SD in Original Scale                                                                                                                      |   | 1475   | SD in Log Scale                                      |   | 0.82  |   |   |   |   |   |   |
| 5032 | 95% t UCL (assumes normality of ROS data)                                                                                                 |   | 753.3  | 95% Percentile Bootstrap UCL                         |   | 770.7 |   |   |   |   |   |   |
| 5033 | 95% BCA Bootstrap UCL                                                                                                                     |   | 837.3  | 95% Bootstrap t UCL                                  |   | 936.6 |   |   |   |   |   |   |
| 5034 | 95% H-UCL (Log ROS)                                                                                                                       |   | 561.6  |                                                      |   |       |   |   |   |   |   |   |
| 5035 |                                                                                                                                           |   |        |                                                      |   |       |   |   |   |   |   |   |
| 5036 | <b>Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution</b>                                                   |   |        |                                                      |   |       |   |   |   |   |   |   |
| 5037 | KM Mean (logged)                                                                                                                          |   | 5.875  | KM Geo Mean                                          |   | 356   |   |   |   |   |   |   |
| 5038 | KM SD (logged)                                                                                                                            |   | 0.843  | 95% Critical H Value (KM-Log)                        |   | 2.023 |   |   |   |   |   |   |
| 5039 | KM Standard Error of Mean (logged)                                                                                                        |   | 0.0575 | 95% H-UCL (KM -Log)                                  |   | 570.6 |   |   |   |   |   |   |
| 5040 | KM SD (logged)                                                                                                                            |   | 0.843  | 95% Critical H Value (KM-Log)                        |   | 2.023 |   |   |   |   |   |   |
| 5041 | KM Standard Error of Mean (logged)                                                                                                        |   | 0.0575 |                                                      |   |       |   |   |   |   |   |   |
| 5042 |                                                                                                                                           |   |        |                                                      |   |       |   |   |   |   |   |   |
| 5043 | <b>DL/2 Statistics</b>                                                                                                                    |   |        |                                                      |   |       |   |   |   |   |   |   |
| 5044 | <b>DL/2 Normal</b>                                                                                                                        |   |        | <b>DL/2 Log-Transformed</b>                          |   |       |   |   |   |   |   |   |
| 5045 | Mean in Original Scale                                                                                                                    |   | 587.3  | Mean in Log Scale                                    |   | 5.872 |   |   |   |   |   |   |
| 5046 | SD in Original Scale                                                                                                                      |   | 1475   | SD in Log Scale                                      |   | 0.86  |   |   |   |   |   |   |
| 5047 | 95% t UCL (Assumes normality)                                                                                                             |   | 753.1  | 95% H-Stat UCL                                       |   | 578.7 |   |   |   |   |   |   |
| 5048 | <b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>                                                  |   |        |                                                      |   |       |   |   |   |   |   |   |
| 5049 |                                                                                                                                           |   |        |                                                      |   |       |   |   |   |   |   |   |
| 5050 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                     |   |        |                                                      |   |       |   |   |   |   |   |   |
| 5051 | <b>Data do not follow a Discernible Distribution at 5% Significance Level</b>                                                             |   |        |                                                      |   |       |   |   |   |   |   |   |
| 5052 |                                                                                                                                           |   |        |                                                      |   |       |   |   |   |   |   |   |
| 5053 | <b>Suggested UCL to Use</b>                                                                                                               |   |        |                                                      |   |       |   |   |   |   |   |   |
| 5054 | 95% KM (Chebyshev) UCL                                                                                                                    |   | 1025   |                                                      |   |       |   |   |   |   |   |   |
| 5055 |                                                                                                                                           |   |        |                                                      |   |       |   |   |   |   |   |   |
| 5056 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |   |        |                                                      |   |       |   |   |   |   |   |   |
| 5057 | Recommendations are based upon data size, data distribution, and skewness.                                                                |   |        |                                                      |   |       |   |   |   |   |   |   |
| 5058 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |   |        |                                                      |   |       |   |   |   |   |   |   |
| 5059 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |   |        |                                                      |   |       |   |   |   |   |   |   |
| 5060 |                                                                                                                                           |   |        |                                                      |   |       |   |   |   |   |   |   |

|    | A                                                                                                         | B                                                     | C        | E | F | G | H | I | J | K | L |
|----|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------|----------|---|---|---|---|---|---|---|---|
| 1  | <b>Wilcoxon-Mann-Whitney Sample 1 vs Sample 2 Comparison Test for Uncensor Full Data Sets without NDs</b> |                                                       |          |   |   |   |   |   |   |   |   |
| 2  |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |   |
| 3  | User Selected Options                                                                                     |                                                       |          |   |   |   |   |   |   |   |   |
| 4  | Date/Time of Computation                                                                                  | ProUCL 5.14/23/2019 10:29:47 AM                       |          |   |   |   |   |   |   |   |   |
| 5  | From File                                                                                                 | BkgCompare_FishEU8_Input_Pb_v3.xls                    |          |   |   |   |   |   |   |   |   |
| 6  | Full Precision                                                                                            | OFF                                                   |          |   |   |   |   |   |   |   |   |
| 7  | Confidence Coefficient                                                                                    | 95%                                                   |          |   |   |   |   |   |   |   |   |
| 8  | Substantial Difference                                                                                    | 0.000                                                 |          |   |   |   |   |   |   |   |   |
| 9  | Selected Null Hypothesis                                                                                  | Sample 1 Mean/Median >= Sample 2 Mean/Median (Form 2) |          |   |   |   |   |   |   |   |   |
| 10 | Alternative Hypothesis                                                                                    | Sample 1 Mean/Median < Sample 2 Mean/Median           |          |   |   |   |   |   |   |   |   |
| 11 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |   |
| 12 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |   |
| 13 | <b>Sample 1 Data: Lead</b>                                                                                |                                                       |          |   |   |   |   |   |   |   |   |
| 14 | <b>Sample 2 Data: BkgLead</b>                                                                             |                                                       |          |   |   |   |   |   |   |   |   |
| 15 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |   |
| 16 | <b>Raw Statistics</b>                                                                                     |                                                       |          |   |   |   |   |   |   |   |   |
| 17 |                                                                                                           | Sample 1                                              | Sample 2 |   |   |   |   |   |   |   |   |
| 18 | Number of Valid Observations                                                                              | 8                                                     | 5        |   |   |   |   |   |   |   |   |
| 19 | Number of Distinct Observations                                                                           | 8                                                     | 5        |   |   |   |   |   |   |   |   |
| 20 | Minimum                                                                                                   | 0.0108                                                | 0.0159   |   |   |   |   |   |   |   |   |
| 21 | Maximum                                                                                                   | 0.0685                                                | 0.142    |   |   |   |   |   |   |   |   |
| 22 | Mean                                                                                                      | 0.0368                                                | 0.0762   |   |   |   |   |   |   |   |   |
| 23 | Median                                                                                                    | 0.0413                                                | 0.0976   |   |   |   |   |   |   |   |   |
| 24 | SD                                                                                                        | 0.0224                                                | 0.0545   |   |   |   |   |   |   |   |   |
| 25 | SE of Mean                                                                                                | 0.00793                                               | 0.0244   |   |   |   |   |   |   |   |   |
| 26 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |   |
| 27 | <b>Wilcoxon-Mann-Whitney (WMW) Test</b>                                                                   |                                                       |          |   |   |   |   |   |   |   |   |
| 28 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |   |
| 29 | <b>H0: Mean/Median of Sample 1 &gt;= Mean/Median of Sample 2</b>                                          |                                                       |          |   |   |   |   |   |   |   |   |
| 30 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |   |
| 31 | Sample 1 Rank Sum W-Stat                                                                                  | 46                                                    |          |   |   |   |   |   |   |   |   |
| 32 | WMW U-Stat                                                                                                | 10                                                    |          |   |   |   |   |   |   |   |   |
| 33 | Mean (U)                                                                                                  | 20                                                    |          |   |   |   |   |   |   |   |   |
| 34 | SD(U) - Adj ties                                                                                          | 6.831                                                 |          |   |   |   |   |   |   |   |   |
| 35 | WMW U-Stat Critical Value (0.05)                                                                          | 9                                                     |          |   |   |   |   |   |   |   |   |
| 36 | Standardized WMW U-Stat                                                                                   | -1.537                                                |          |   |   |   |   |   |   |   |   |
| 37 | Approximate P-Value                                                                                       | 0.0621                                                |          |   |   |   |   |   |   |   |   |
| 38 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |   |
| 39 | <b>Conclusion with Alpha = 0.05</b>                                                                       |                                                       |          |   |   |   |   |   |   |   |   |
| 40 | <b>Do Not Reject H0, Conclude Sample 1 &gt;= Sample 2</b>                                                 |                                                       |          |   |   |   |   |   |   |   |   |
| 41 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |   |

| A  | B                                                                                                | C                                                     | E        | F | G | H | I | J | K | L |
|----|--------------------------------------------------------------------------------------------------|-------------------------------------------------------|----------|---|---|---|---|---|---|---|
| 1  | <b>Wilcoxon-Mann-Whitney Sample 1 vs Sample 2 Comparison Test for Data Sets with Non-Detects</b> |                                                       |          |   |   |   |   |   |   |   |
| 2  |                                                                                                  |                                                       |          |   |   |   |   |   |   |   |
| 3  | User Selected Options                                                                            |                                                       |          |   |   |   |   |   |   |   |
| 4  | Date/Time of Computation                                                                         | ProUCL 5.14/23/2019 10:25:20 AM                       |          |   |   |   |   |   |   |   |
| 5  | From File                                                                                        | BkgCompare_FishEU9_Input_Pb_v3.xls                    |          |   |   |   |   |   |   |   |
| 6  | Full Precision                                                                                   | OFF                                                   |          |   |   |   |   |   |   |   |
| 7  | Confidence Coefficient                                                                           | 95%                                                   |          |   |   |   |   |   |   |   |
| 8  | Selected Null Hypothesis                                                                         | Sample 1 Mean/Median >= Sample 2 Mean/Median (Form 2) |          |   |   |   |   |   |   |   |
| 9  | Alternative Hypothesis                                                                           | Sample 1 Mean/Median < Sample 2 Mean/Median           |          |   |   |   |   |   |   |   |
| 10 |                                                                                                  |                                                       |          |   |   |   |   |   |   |   |
| 11 |                                                                                                  |                                                       |          |   |   |   |   |   |   |   |
| 12 | <b>Sample 1 Data: Lead</b>                                                                       |                                                       |          |   |   |   |   |   |   |   |
| 13 | <b>Sample 2 Data: BkgLead</b>                                                                    |                                                       |          |   |   |   |   |   |   |   |
| 14 |                                                                                                  |                                                       |          |   |   |   |   |   |   |   |
| 15 | <b>Raw Statistics</b>                                                                            |                                                       |          |   |   |   |   |   |   |   |
| 16 |                                                                                                  | Sample 1                                              | Sample 2 |   |   |   |   |   |   |   |
| 17 | Number of Valid Data                                                                             | 5                                                     | 5        |   |   |   |   |   |   |   |
| 18 | Number of Non-Detects                                                                            | 1                                                     | 4        |   |   |   |   |   |   |   |
| 19 | Number of Detect Data                                                                            | 4                                                     | 1        |   |   |   |   |   |   |   |
| 20 | Minimum Non-Detect                                                                               | 0.0101                                                | 0.0104   |   |   |   |   |   |   |   |
| 21 | Maximum Non-Detect                                                                               | 0.0101                                                | 0.0112   |   |   |   |   |   |   |   |
| 22 | Percent Non-detects                                                                              | 20.00%                                                | 80.00%   |   |   |   |   |   |   |   |
| 23 | Minimum Detect                                                                                   | 0.0119                                                | 0.0117   |   |   |   |   |   |   |   |
| 24 | Maximum Detect                                                                                   | 0.0609                                                | 0.0117   |   |   |   |   |   |   |   |
| 25 | Mean of Detects                                                                                  | 0.0264                                                | 0.0117   |   |   |   |   |   |   |   |
| 26 | Median of Detects                                                                                | 0.0164                                                | 0.0117   |   |   |   |   |   |   |   |
| 27 | SD of Detects                                                                                    | 0.0232                                                | N/A      |   |   |   |   |   |   |   |
| 28 |                                                                                                  |                                                       |          |   |   |   |   |   |   |   |
| 29 | <b>WMW test is meant for a Single Detection Limit Case</b>                                       |                                                       |          |   |   |   |   |   |   |   |
| 30 | of Gehan or T-W test is suggested when multiple detection limits are prese                       |                                                       |          |   |   |   |   |   |   |   |
| 31 | All observations <= 0.0112 (Max DL) are ranked the same                                          |                                                       |          |   |   |   |   |   |   |   |
| 32 |                                                                                                  |                                                       |          |   |   |   |   |   |   |   |
| 33 | <b>Wilcoxon-Mann-Whitney (WMW) Test</b>                                                          |                                                       |          |   |   |   |   |   |   |   |
| 34 |                                                                                                  |                                                       |          |   |   |   |   |   |   |   |
| 35 | <b>H0: Mean/Median of Sample 1 &gt;= Mean/Median of Sample 2</b>                                 |                                                       |          |   |   |   |   |   |   |   |
| 36 |                                                                                                  |                                                       |          |   |   |   |   |   |   |   |
| 37 | Sample 1 Rank Sum W-Stat                                                                         | 37                                                    |          |   |   |   |   |   |   |   |
| 38 | WMW U-Stat                                                                                       | 22                                                    |          |   |   |   |   |   |   |   |
| 39 | Mean (U)                                                                                         | 12.5                                                  |          |   |   |   |   |   |   |   |
| 40 | SD(U) - Adj ties                                                                                 | 4.787                                                 |          |   |   |   |   |   |   |   |
| 41 | WMW U-Stat Critical Value (0.05)                                                                 | 5                                                     |          |   |   |   |   |   |   |   |
| 42 | Standardized WMW U-Stat                                                                          | 2.006                                                 |          |   |   |   |   |   |   |   |
| 43 | Approximate P-Value                                                                              | 0.978                                                 |          |   |   |   |   |   |   |   |
| 44 |                                                                                                  |                                                       |          |   |   |   |   |   |   |   |
| 45 | <b>Conclusion with Alpha = 0.05</b>                                                              |                                                       |          |   |   |   |   |   |   |   |
| 46 | <b>Do Not Reject H0, Conclude Sample 1 &gt;= Sample 2</b>                                        |                                                       |          |   |   |   |   |   |   |   |
| 47 |                                                                                                  |                                                       |          |   |   |   |   |   |   |   |

| A  | B                                                                                                         | C                                                     | E        | F | G | H | I | J | K | L |
|----|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------|----------|---|---|---|---|---|---|---|
| 1  | <b>Wilcoxon-Mann-Whitney Sample 1 vs Sample 2 Comparison Test for Uncensor Full Data Sets without NDs</b> |                                                       |          |   |   |   |   |   |   |   |
| 2  |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 3  | User Selected Options                                                                                     |                                                       |          |   |   |   |   |   |   |   |
| 4  | Date/Time of Computation                                                                                  | ProUCL 5.14/23/2019 9:59:50 AM                        |          |   |   |   |   |   |   |   |
| 5  | From File                                                                                                 | BPMD_HHRA_ATVGuide_SoilInput_Pb_v2.xls                |          |   |   |   |   |   |   |   |
| 6  | Full Precision                                                                                            | OFF                                                   |          |   |   |   |   |   |   |   |
| 7  | Confidence Coefficient                                                                                    | 95%                                                   |          |   |   |   |   |   |   |   |
| 8  | Substantial Difference                                                                                    | 0.000                                                 |          |   |   |   |   |   |   |   |
| 9  | Selected Null Hypothesis                                                                                  | Sample 1 Mean/Median >= Sample 2 Mean/Median (Form 2) |          |   |   |   |   |   |   |   |
| 10 | Alternative Hypothesis                                                                                    | Sample 1 Mean/Median < Sample 2 Mean/Median           |          |   |   |   |   |   |   |   |
| 11 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 12 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 13 | <b>Sample 1 Data: Lead</b>                                                                                |                                                       |          |   |   |   |   |   |   |   |
| 14 | <b>Sample 2 Data: BkgLead</b>                                                                             |                                                       |          |   |   |   |   |   |   |   |
| 15 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 16 | <b>Raw Statistics</b>                                                                                     |                                                       |          |   |   |   |   |   |   |   |
| 17 |                                                                                                           | Sample 1                                              | Sample 2 |   |   |   |   |   |   |   |
| 18 | Number of Valid Observations                                                                              | 36                                                    | 34       |   |   |   |   |   |   |   |
| 19 | Number of Distinct Observations                                                                           | 36                                                    | 33       |   |   |   |   |   |   |   |
| 20 | Minimum                                                                                                   | 46.7                                                  | 10       |   |   |   |   |   |   |   |
| 21 | Maximum                                                                                                   | 2540                                                  | 431      |   |   |   |   |   |   |   |
| 22 | Mean                                                                                                      | 336.8                                                 | 100.4    |   |   |   |   |   |   |   |
| 23 | Median                                                                                                    | 220.5                                                 | 62.85    |   |   |   |   |   |   |   |
| 24 | SD                                                                                                        | 451.1                                                 | 119.8    |   |   |   |   |   |   |   |
| 25 | SE of Mean                                                                                                | 75.18                                                 | 20.54    |   |   |   |   |   |   |   |
| 26 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 27 | <b>Wilcoxon-Mann-Whitney (WMW) Test</b>                                                                   |                                                       |          |   |   |   |   |   |   |   |
| 28 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 29 | <b>H0: Mean/Median of Sample 1 &gt;= Mean/Median of Sample 2</b>                                          |                                                       |          |   |   |   |   |   |   |   |
| 30 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 31 | Sample 1 Rank Sum W-Stat                                                                                  | 1670                                                  |          |   |   |   |   |   |   |   |
| 32 | Standardized WMW U-Stat                                                                                   | 4.595                                                 |          |   |   |   |   |   |   |   |
| 33 | Mean (U)                                                                                                  | 612                                                   |          |   |   |   |   |   |   |   |
| 34 | SD(U) - Adj ties                                                                                          | 85.1                                                  |          |   |   |   |   |   |   |   |
| 35 | Approximate U-Stat Critical Value (0.05)                                                                  | -1.645                                                |          |   |   |   |   |   |   |   |
| 36 | P-Value (Adjusted for Ties)                                                                               | 1                                                     |          |   |   |   |   |   |   |   |
| 37 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 38 | <b>Conclusion with Alpha = 0.05</b>                                                                       |                                                       |          |   |   |   |   |   |   |   |
| 39 | <b>Do Not Reject H0, Conclude Sample 1 &gt;= Sample 2</b>                                                 |                                                       |          |   |   |   |   |   |   |   |
| 40 | <b>P-Value &gt;= alpha (0.05)</b>                                                                         |                                                       |          |   |   |   |   |   |   |   |
| 41 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |

| A  | B                                                                                                         | C                                                     | E        | F | G | H | I | J | K | L |
|----|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------|----------|---|---|---|---|---|---|---|
| 1  | <b>Wilcoxon-Mann-Whitney Sample 1 vs Sample 2 Comparison Test for Uncensor Full Data Sets without NDs</b> |                                                       |          |   |   |   |   |   |   |   |
| 2  |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 3  | User Selected Options                                                                                     |                                                       |          |   |   |   |   |   |   |   |
| 4  | Date/Time of Computation                                                                                  | ProUCL 5.14/23/2019 10:03:20 AM                       |          |   |   |   |   |   |   |   |
| 5  | From File                                                                                                 | BPMD_HHRA_ATVGuide_SoilInput_Smithetal_Pb_v2.xls      |          |   |   |   |   |   |   |   |
| 6  | Full Precision                                                                                            | OFF                                                   |          |   |   |   |   |   |   |   |
| 7  | Confidence Coefficient                                                                                    | 95%                                                   |          |   |   |   |   |   |   |   |
| 8  | Substantial Difference                                                                                    | 0.000                                                 |          |   |   |   |   |   |   |   |
| 9  | Selected Null Hypothesis                                                                                  | Sample 1 Mean/Median >= Sample 2 Mean/Median (Form 2) |          |   |   |   |   |   |   |   |
| 10 | Alternative Hypothesis                                                                                    | Sample 1 Mean/Median < Sample 2 Mean/Median           |          |   |   |   |   |   |   |   |
| 11 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 12 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 13 | <b>Sample 1 Data: Lead</b>                                                                                |                                                       |          |   |   |   |   |   |   |   |
| 14 | <b>Sample 2 Data: BkgLead</b>                                                                             |                                                       |          |   |   |   |   |   |   |   |
| 15 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 16 | <b>Raw Statistics</b>                                                                                     |                                                       |          |   |   |   |   |   |   |   |
| 17 |                                                                                                           | Sample 1                                              | Sample 2 |   |   |   |   |   |   |   |
| 18 | Number of Valid Observations                                                                              | 36                                                    | 36       |   |   |   |   |   |   |   |
| 19 | Number of Distinct Observations                                                                           | 36                                                    | 36       |   |   |   |   |   |   |   |
| 20 | Minimum                                                                                                   | 46.7                                                  | 15.9     |   |   |   |   |   |   |   |
| 21 | Maximum                                                                                                   | 2540                                                  | 312      |   |   |   |   |   |   |   |
| 22 | Mean                                                                                                      | 336.8                                                 | 45.57    |   |   |   |   |   |   |   |
| 23 | Median                                                                                                    | 220.5                                                 | 30.25    |   |   |   |   |   |   |   |
| 24 | SD                                                                                                        | 451.1                                                 | 54.17    |   |   |   |   |   |   |   |
| 25 | SE of Mean                                                                                                | 75.18                                                 | 9.029    |   |   |   |   |   |   |   |
| 26 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 27 | <b>Wilcoxon-Mann-Whitney (WMW) Test</b>                                                                   |                                                       |          |   |   |   |   |   |   |   |
| 28 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 29 | <b>H0: Mean/Median of Sample 1 &gt;= Mean/Median of Sample 2</b>                                          |                                                       |          |   |   |   |   |   |   |   |
| 30 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 31 | Sample 1 Rank Sum W-Stat                                                                                  | 1907                                                  |          |   |   |   |   |   |   |   |
| 32 | Standardized WMW U-Stat                                                                                   | 6.673                                                 |          |   |   |   |   |   |   |   |
| 33 | Mean (U)                                                                                                  | 648                                                   |          |   |   |   |   |   |   |   |
| 34 | SD(U) - Adj ties                                                                                          | 88.79                                                 |          |   |   |   |   |   |   |   |
| 35 | Approximate U-Stat Critical Value (0.05)                                                                  | -1.645                                                |          |   |   |   |   |   |   |   |
| 36 | P-Value (Adjusted for Ties)                                                                               | 1                                                     |          |   |   |   |   |   |   |   |
| 37 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 38 | <b>Conclusion with Alpha = 0.05</b>                                                                       |                                                       |          |   |   |   |   |   |   |   |
| 39 | <b>Do Not Reject H0, Conclude Sample 1 &gt;= Sample 2</b>                                                 |                                                       |          |   |   |   |   |   |   |   |
| 40 | <b>P-Value &gt;= alpha (0.05)</b>                                                                         |                                                       |          |   |   |   |   |   |   |   |
| 41 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |

| A  | B                                                                                                         | C                                                     | E        | F | G | H | I | J | K | L |
|----|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------|----------|---|---|---|---|---|---|---|
| 1  | <b>Wilcoxon-Mann-Whitney Sample 1 vs Sample 2 Comparison Test for Uncensor Full Data Sets without NDs</b> |                                                       |          |   |   |   |   |   |   |   |
| 2  |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 3  | User Selected Options                                                                                     |                                                       |          |   |   |   |   |   |   |   |
| 4  | Date/Time of Computation                                                                                  | ProUCL 5.14/23/2019 10:02:02 AM                       |          |   |   |   |   |   |   |   |
| 5  | From File                                                                                                 | BPMD_HHRA_ATVRec_SoilInput_Pb_v2.xls                  |          |   |   |   |   |   |   |   |
| 6  | Full Precision                                                                                            | OFF                                                   |          |   |   |   |   |   |   |   |
| 7  | Confidence Coefficient                                                                                    | 95%                                                   |          |   |   |   |   |   |   |   |
| 8  | Substantial Difference                                                                                    | 0.000                                                 |          |   |   |   |   |   |   |   |
| 9  | Selected Null Hypothesis                                                                                  | Sample 1 Mean/Median >= Sample 2 Mean/Median (Form 2) |          |   |   |   |   |   |   |   |
| 10 | Alternative Hypothesis                                                                                    | Sample 1 Mean/Median < Sample 2 Mean/Median           |          |   |   |   |   |   |   |   |
| 11 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 12 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 13 | <b>Sample 1 Data: Lead</b>                                                                                |                                                       |          |   |   |   |   |   |   |   |
| 14 | <b>Sample 2 Data: BkgLead</b>                                                                             |                                                       |          |   |   |   |   |   |   |   |
| 15 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 16 | <b>Raw Statistics</b>                                                                                     |                                                       |          |   |   |   |   |   |   |   |
| 17 |                                                                                                           | Sample 1                                              | Sample 2 |   |   |   |   |   |   |   |
| 18 | Number of Valid Observations                                                                              | 83                                                    | 34       |   |   |   |   |   |   |   |
| 19 | Number of Distinct Observations                                                                           | 81                                                    | 33       |   |   |   |   |   |   |   |
| 20 | Minimum                                                                                                   | 13.7                                                  | 10       |   |   |   |   |   |   |   |
| 21 | Maximum                                                                                                   | 18300                                                 | 431      |   |   |   |   |   |   |   |
| 22 | Mean                                                                                                      | 1252                                                  | 100.4    |   |   |   |   |   |   |   |
| 23 | Median                                                                                                    | 346                                                   | 62.85    |   |   |   |   |   |   |   |
| 24 | SD                                                                                                        | 2882                                                  | 119.8    |   |   |   |   |   |   |   |
| 25 | SE of Mean                                                                                                | 316.3                                                 | 20.54    |   |   |   |   |   |   |   |
| 26 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 27 | <b>Wilcoxon-Mann-Whitney (WMW) Test</b>                                                                   |                                                       |          |   |   |   |   |   |   |   |
| 28 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 29 | <b>H0: Mean/Median of Sample 1 &gt;= Mean/Median of Sample 2</b>                                          |                                                       |          |   |   |   |   |   |   |   |
| 30 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 31 | Sample 1 Rank Sum W-Stat                                                                                  | 5879                                                  |          |   |   |   |   |   |   |   |
| 32 | Standardized WMW U-Stat                                                                                   | 5.889                                                 |          |   |   |   |   |   |   |   |
| 33 | Mean (U)                                                                                                  | 1411                                                  |          |   |   |   |   |   |   |   |
| 34 | SD(U) - Adj ties                                                                                          | 166.6                                                 |          |   |   |   |   |   |   |   |
| 35 | Approximate U-Stat Critical Value (0.05)                                                                  | -1.645                                                |          |   |   |   |   |   |   |   |
| 36 | P-Value (Adjusted for Ties)                                                                               | 1                                                     |          |   |   |   |   |   |   |   |
| 37 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 38 | <b>Conclusion with Alpha = 0.05</b>                                                                       |                                                       |          |   |   |   |   |   |   |   |
| 39 | <b>Do Not Reject H0, Conclude Sample 1 &gt;= Sample 2</b>                                                 |                                                       |          |   |   |   |   |   |   |   |
| 40 | <b>P-Value &gt;= alpha (0.05)</b>                                                                         |                                                       |          |   |   |   |   |   |   |   |
| 41 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |

| A  | B                                                                                                         | C                                                     | E        | F | G | H | I | J | K | L |
|----|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------|----------|---|---|---|---|---|---|---|
| 1  | <b>Wilcoxon-Mann-Whitney Sample 1 vs Sample 2 Comparison Test for Uncensor Full Data Sets without NDs</b> |                                                       |          |   |   |   |   |   |   |   |
| 2  |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 3  | User Selected Options                                                                                     |                                                       |          |   |   |   |   |   |   |   |
| 4  | Date/Time of Computation                                                                                  | ProUCL 5.14/23/2019 10:04:39 AM                       |          |   |   |   |   |   |   |   |
| 5  | From File                                                                                                 | BPMD_HHRA_ATVRec_SoilInput_Smithetal_Pb_v2.xls        |          |   |   |   |   |   |   |   |
| 6  | Full Precision                                                                                            | OFF                                                   |          |   |   |   |   |   |   |   |
| 7  | Confidence Coefficient                                                                                    | 95%                                                   |          |   |   |   |   |   |   |   |
| 8  | Substantial Difference                                                                                    | 0.000                                                 |          |   |   |   |   |   |   |   |
| 9  | Selected Null Hypothesis                                                                                  | Sample 1 Mean/Median >= Sample 2 Mean/Median (Form 2) |          |   |   |   |   |   |   |   |
| 10 | Alternative Hypothesis                                                                                    | Sample 1 Mean/Median < Sample 2 Mean/Median           |          |   |   |   |   |   |   |   |
| 11 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 12 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 13 | <b>Sample 1 Data: Lead</b>                                                                                |                                                       |          |   |   |   |   |   |   |   |
| 14 | <b>Sample 2 Data: BkgLead</b>                                                                             |                                                       |          |   |   |   |   |   |   |   |
| 15 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 16 | <b>Raw Statistics</b>                                                                                     |                                                       |          |   |   |   |   |   |   |   |
| 17 |                                                                                                           | Sample 1                                              | Sample 2 |   |   |   |   |   |   |   |
| 18 | Number of Valid Observations                                                                              | 83                                                    | 36       |   |   |   |   |   |   |   |
| 19 | Number of Distinct Observations                                                                           | 81                                                    | 36       |   |   |   |   |   |   |   |
| 20 | Minimum                                                                                                   | 13.7                                                  | 15.9     |   |   |   |   |   |   |   |
| 21 | Maximum                                                                                                   | 18300                                                 | 312      |   |   |   |   |   |   |   |
| 22 | Mean                                                                                                      | 1252                                                  | 45.57    |   |   |   |   |   |   |   |
| 23 | Median                                                                                                    | 346                                                   | 30.25    |   |   |   |   |   |   |   |
| 24 | SD                                                                                                        | 2882                                                  | 54.17    |   |   |   |   |   |   |   |
| 25 | SE of Mean                                                                                                | 316.3                                                 | 9.029    |   |   |   |   |   |   |   |
| 26 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 27 | <b>Wilcoxon-Mann-Whitney (WMW) Test</b>                                                                   |                                                       |          |   |   |   |   |   |   |   |
| 28 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 29 | <b>H0: Mean/Median of Sample 1 &gt;= Mean/Median of Sample 2</b>                                          |                                                       |          |   |   |   |   |   |   |   |
| 30 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 31 | Sample 1 Rank Sum W-Stat                                                                                  | 6292                                                  |          |   |   |   |   |   |   |   |
| 32 | Standardized WMW U-Stat                                                                                   | 7.584                                                 |          |   |   |   |   |   |   |   |
| 33 | Mean (U)                                                                                                  | 1494                                                  |          |   |   |   |   |   |   |   |
| 34 | SD(U) - Adj ties                                                                                          | 172.9                                                 |          |   |   |   |   |   |   |   |
| 35 | Approximate U-Stat Critical Value (0.05)                                                                  | -1.645                                                |          |   |   |   |   |   |   |   |
| 36 | P-Value (Adjusted for Ties)                                                                               | 1                                                     |          |   |   |   |   |   |   |   |
| 37 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |
| 38 | <b>Conclusion with Alpha = 0.05</b>                                                                       |                                                       |          |   |   |   |   |   |   |   |
| 39 | <b>Do Not Reject H0, Conclude Sample 1 &gt;= Sample 2</b>                                                 |                                                       |          |   |   |   |   |   |   |   |
| 40 | <b>P-Value &gt;= alpha (0.05)</b>                                                                         |                                                       |          |   |   |   |   |   |   |   |
| 41 |                                                                                                           |                                                       |          |   |   |   |   |   |   |   |

## Appendix C

# Derivation of Particulate Emission Factor for ATV Riding

## 1.0 Introduction

One pathway that humans may be exposed to contaminants in soil is by inhalation of particles of soil that become re-suspended in air. When reliable site-specific measurements of contaminant levels in air due to re-suspended soil particles are not available<sup>1</sup>, the concentration of contaminants may be estimated as follows (U.S. Environmental Protection Agency [EPA] 1996, 2002):

$$C_{air} = C_{soil} \cdot PEF$$

where:

|            |   |                                                              |
|------------|---|--------------------------------------------------------------|
| $C_{air}$  | = | Concentration of contaminant in air (mg/m <sup>3</sup> )     |
| $C_{soil}$ | = | Concentration of contaminant in soil (mg/kg)                 |
| $PEF$      | = | Soil to air particulate emission factor (kg/m <sup>3</sup> ) |

Note, the particulate emission factor (PEF) term in this equation is the inverse of the value presented in EPA (1996, 2002), which has units of m<sup>3</sup>/kg.

The value of the PEF depends on a number of site-specific factors, such as soil conditions (e.g., soil moisture, vegetation cover, presence of rocks, soil type), as well as the nature of the soil disturbance activity (wind, mechanical disturbance) that leads to soil particle re-suspension in air. The following sections present the derivation of the PEF value used to estimate contaminant concentrations in air from the re-suspension of soil attributable to riding all-terrain vehicles (ATVs).

## 2.0 Estimation of the PEF

Site-specific data on particulate emissions during ATV riding were collected in the fall of 2018 in accordance with (EPA 2018a, 2018b). The ATV activity-based sampling (ABS) was conducted with single operators on two ATVs driven on the Alpine Loop within the confines of the Site and a remote roadway while the operators wore appropriate PPE in accordance with the governing SAP. The first ATV was the leader and the second ATV rider was the follower. The follower maintained a safe following distance, similar to what would be expected under normal ATV riding conditions (i.e., as if the operators were not wearing respirators). The distance between ATVs

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<sup>1</sup> Site-specific measurements of contaminant levels in air due to re-suspended soil particles are available for ATV guides because samples from the entire Alpine Loop within the Site were collected in the fall of 2018. However, recreational ATV rider risk is evaluated based on all roadways at the Site, not just the Alpine Loop; therefore, it is necessary to predict air concentrations while riding outside the Alpine Loop.

depended on the terrain and amount of dust generated by the lead ATV; the following distance was less than 50 yards under less dusty conditions and was as much as 200 yards under very dry, dusty conditions. ATVs were operated at appropriate speeds depending on terrain and safety considerations. SKC-brand personal air samplers with cyclones were attached to each ATV to obtain the respirable dust (e.g., 4 microns); the intakes for these samplers were placed near the breathing zone of the ATV operator. Roadway soil and ATV ABS air samples were collected throughout the Alpine Loop and along remote location off of the Alpine Loop (on and near County Road 4). Site conditions during the sampling include the following:

- Roadways consisted of hard-packed soil with exposed bedrock, roadways are not graded/maintained with the exception of maintaining a stable shoulder.
- Wind speeds averaged about 8 miles per hour on both ATV ABS sampling days.

The PEF for ATV riding was estimated by taking the mean concentration in air generated during ATV use and dividing by the mean soil concentration for the corresponding roadways traversed during the ABS activity. This calculation is as follows:

$$PEF_{atv} = C_{air} / C_{soil}$$

where:

|             |   |                                                                    |
|-------------|---|--------------------------------------------------------------------|
| $PEF_{atv}$ | = | Particulate emission factor for ATV riding (kg/m <sup>3</sup> )    |
| $C_{air}$   | = | Concentration in air based on respirable dust (µg/m <sup>3</sup> ) |
| $C_{soil}$  | = | Concentration in roadway soil (µg/kg)                              |

For this evaluation, the PEF was calculated using air and soil data for manganese. This was because other metals analyzed in the ATV ABS air samples were either not detected, not selected as chemicals of potential concern, or lacking inhalation-specific toxicity information. It is not anticipated that release of metals in dust to air would be chemical-specific; thus, the manganese-specific PEF can be applied to all metals. When calculating the PEF, focus was also placed on the following rider because air concentrations for the leader were often non-detect. Use of a follower-specific PEF will provide conservative estimates of air concentrations for a leader rider. The detailed analytical results used to compute the PEF are presented in **Attachment 1**.

PEF values were calculated separately for both the Alpine loop and the remote location based on the inputs presented in **Table C-1** below. Based on these inputs, the resulting PEF for ATV riding is estimated to be 5.6E-07 kg/m<sup>3</sup> and 2.0E-07 kg/m<sup>3</sup> for the Alpine Loop and remote location, respectively.

**Table C-1. Inputs Used to Calculate PEF for Recreational ATV Riding**

| Location        | Parameter  | Parameter Definition                    | Value    | Units                    | Notes                                                                          |
|-----------------|------------|-----------------------------------------|----------|--------------------------|--------------------------------------------------------------------------------|
| Alpine Loop     | $C_{air}$  | Concentration in air based on PM10 dust | 0.762    | $\mu\text{g}/\text{m}^3$ | Mean manganese air concentration for following rider from the Alpine Loop.     |
|                 | $C_{soil}$ | Concentration in roadway soil           | 1.35E+06 | $\mu\text{g}/\text{kg}$  | Mean roadway soil concentration for samples from the Alpine Loop.              |
| Remote Location | $C_{air}$  | Concentration in air based on PM10 dust | 0.585    | $\mu\text{g}/\text{m}^3$ | Mean manganese air concentration for following rider from the remote location. |
|                 | $C_{soil}$ | Concentration in roadway soil           | 2.92E+06 | $\mu\text{g}/\text{kg}$  | Mean roadway soil concentration for samples from the remote location.          |

Note, the PEF values for both locations are generally similar (within a factor of 3 of each other). This is expected because the road conditions for the Alpine Loop and the remote location were generally similar. For the purposes of estimating air concentrations for use in the risk calculations, the PEF for the Alpine Loop ( $5.6\text{E}-07 \text{ kg}/\text{m}^3$ ) was selected because it will result in higher predicted air concentrations and, hence, more conservative risk estimates.

### 3.0 References

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EPA. 2002. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites*. OSWER 9355.4-24. December.

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**ATTACHMENT 1. ANALYTICAL RESULTS FOR ROADWAY SOIL AND ATV ABS AIR**

*Bonita Peak Mining District*

**Panel A. Roadway Soil - Alpine Loop**

| Samp_No   | Sample Date | Location | Sub_Location | Analytical Method | Extraction_Method | CAS_NO    | Analyte   | Result | Result_Qualifier | Lab_Result_Qualifier | Result_Units | MDL   | MDL_Units    |
|-----------|-------------|----------|--------------|-------------------|-------------------|-----------|-----------|--------|------------------|----------------------|--------------|-------|--------------|
| MH1E32    | 7/26/16     | RD1CR1   | RD1CR1       | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 1370   |                  |                      | mg/kg        | 0.063 | mg/kg        |
| MH1E33    | 7/27/16     | RD1CR2   | RD1CR2       | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 1930   |                  | D*                   | mg/kg        | 0.12  | mg/kg        |
| MH1E35    | 7/27/16     | RD1CR3   | RD1CR3       | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 1340   |                  | *                    | mg/kg        | 0.061 | mg/kg        |
| MH1E40    | 7/27/16     | RD2CR1   | RD2CR1       | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 1180   |                  | *                    | mg/kg        | 0.063 | mg/kg        |
| MH1E41    | 7/27/16     | RD2CR2   | RD2CR2       | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 1310   |                  | *                    | mg/kg        | 0.063 | mg/kg        |
| MH1E43    | 7/27/16     | RD2CR3   | RD2CR3       | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 1070   |                  | *                    | mg/kg        | 0.063 | mg/kg        |
| MH1E45    | 7/27/16     | RD2CR5   | RD2CR5       | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 1360   |                  | *                    | mg/kg        | 0.065 | mg/kg        |
| MH1E57    | 7/27/16     | RDCC2    | RDCC2        | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 424    | J                | *                    | mg/kg        | 0.064 | mg/kg        |
| MH1E58    | 7/27/16     | RDCC3    | RDCC3        | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 713    | J                | *                    | mg/kg        | 0.065 | mg/kg        |
| MH1E59    | 7/27/16     | RDCC4    | RDCC4        | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 1180   | J                | *                    | mg/kg        | 0.064 | mg/kg        |
| MH1E66    | 7/27/16     | RDCC4    | RDCC4        | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 900    | J                | *                    | mg/kg        | 0.064 | mg/kg        |
| MH1E60    | 7/27/16     | RDCC5    | RDCC5        | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 796    | J                | *                    | mg/kg        | 0.064 | mg/kg        |
| MH1E61    | 7/27/16     | RDCC6    | RDCC6        | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 847    | J                | *                    | mg/kg        | 0.064 | mg/kg        |
| MH1E63    | 7/27/16     | RDCC7    | RDCC7        | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 817    | J                | *                    | mg/kg        | 0.064 | mg/kg        |
| MH1E64    | 7/27/16     | RDCC8    | RDCC8        | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 925    | J                | *                    | mg/kg        | 0.064 | mg/kg        |
| MH1E65    | 7/27/16     | RDCC9    | RDCC9        | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 680    | J                | *                    | mg/kg        | 0.069 | mg/kg        |
| MH1E67    | 7/26/16     | RDEK1    | RDEK1        | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 787    | J                | *                    | mg/kg        | 0.064 | mg/kg        |
| MH1E68    | 7/26/16     | RDEK2    | RDEK2        | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 547    | J                | *                    | mg/kg        | 0.063 | mg/kg        |
| MH1E69    | 7/26/16     | RDEK3    | RDEK3        | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 711    | J                | *                    | mg/kg        | 0.063 | mg/kg        |
| MH1E70    | 7/26/16     | RDEK4    | RDEK4        | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 847    | J                | *                    | mg/kg        | 0.072 | mg/kg        |
| MH1E71    | 7/26/16     | RDEK5    | RDEK5        | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 8990   | J                | D*                   | mg/kg        | 0.38  | mg/kg        |
| MH1E73    | 7/26/16     | RDEK6    | RDEK6        | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 3000   | J                | D*                   | mg/kg        | 0.069 | mg/kg        |
| MH1E74    | 7/26/16     | RDEK7    | RDEK7        | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 2520   | J                | D*                   | mg/kg        | 0.07  | mg/kg        |
| MH1E97    | 7/26/16     | RDPWML1  | RDPWML1      | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 792    |                  |                      | mg/kg        | 0.023 | mg/kg        |
| MH1E98    | 7/26/16     | RDPWML2  | RDPWML2      | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 835    |                  |                      | mg/kg        | 0.023 | mg/kg        |
| MH1E99    | 7/26/16     | RDPWML3  | RDPWML3      | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 634    |                  |                      | mg/kg        | 0.023 | mg/kg        |
| MH1F01    | 7/26/16     | RDPWML4  | RDPWML4      | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 779    |                  |                      | mg/kg        | 0.023 | mg/kg        |
| MH1F02    | 7/26/16     | RDPWML5  | RDPWML5      | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 623    |                  |                      | mg/kg        | 0.023 | mg/kg        |
| A8M5-6036 | 9/27/18     | RDAN1    | RDAN1-10     | EPA 200.2/200.7   | 200.2 - TR Metals | 7439-96-5 | Manganese | 982    | D                | D                    | mg/kg dry wt | 0.998 | mg/kg dry wt |
| A8M5-6037 | 9/27/18     | RDAN2    | RDAN2-10     | EPA 200.2/200.7   | 200.2 - TR Metals | 7439-96-5 | Manganese | 530    | D                | D                    | mg/kg dry wt | 1.01  | mg/kg dry wt |
| A8M5-6038 | 9/27/18     | RDAN3    | RDAN3-10     | EPA 200.2/200.7   | 200.2 - TR Metals | 7439-96-5 | Manganese | 477    | D                | D                    | mg/kg dry wt | 1     | mg/kg dry wt |
| A8M5-6040 | 9/27/18     | RDAN4    | RDAN4-10     | EPA 200.2/200.7   | 200.2 - TR Metals | 7439-96-5 | Manganese | 687    | D                | D                    | mg/kg dry wt | 1     | mg/kg dry wt |
| A8M5-6041 | 9/25/18     | RDAN5    | RDAN5-10     | EPA 200.2/200.7   | 200.2 - TR Metals | 7439-96-5 | Manganese | 1490   | D                | D                    | mg/kg dry wt | 1     | mg/kg dry wt |
| A8M5-6042 | 9/25/18     | RDAN6    | RDAN6-10     | EPA 200.2/200.7   | 200.2 - TR Metals | 7439-96-5 | Manganese | 1980   | D                | D                    | mg/kg dry wt | 1.01  | mg/kg dry wt |
| A8M5-6043 | 9/25/18     | RDAN7    | RDAN7-10     | EPA 200.2/200.7   | 200.2 - TR Metals | 7439-96-5 | Manganese | 2690   | D                | D                    | mg/kg dry wt | 1.01  | mg/kg dry wt |
| A8M5-6044 | 9/25/18     | RDAN8    | RDAN8-10     | EPA 200.2/200.7   | 200.2 - TR Metals | 7439-96-5 | Manganese | 1970   | D                | D                    | mg/kg dry wt | 0.997 | mg/kg dry wt |

**ATTACHMENT 1. ANALYTICAL RESULTS FOR ROADWAY SOIL AND ATV ABS AIR**

*Bonita Peak Mining District*

**Panel B. Roadway Soil - Remote Location**

| Samp_No   | Sample Date | Location | Sub_Location | Analytical Method | Extraction_Method | CAS_NO    | Analyte   | Result | Result_Qu alifier | Lab_Result _Qualifier | Result_ Units | MDL   | MDL_Units    |
|-----------|-------------|----------|--------------|-------------------|-------------------|-----------|-----------|--------|-------------------|-----------------------|---------------|-------|--------------|
| MH1E38    | 7/27/16     | RD1PWMN1 | RD1PWMN1     | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 3780   |                   | D*                    | mg/kg         | 0.2   | mg/kg        |
| MH1E39    | 7/26/16     | RD1PWMN5 | RD1PWMN5     | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 6830   |                   | D*                    | mg/kg         | 0.32  | mg/kg        |
| MH1E46    | 7/26/16     | RD2PWMN1 | RD2PWMN1     | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 1620   |                   | *                     | mg/kg         | 0.063 | mg/kg        |
| MH1E47    | 7/26/16     | RD2PWMN2 | RD2PWMN2     | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 1560   |                   | *                     | mg/kg         | 0.065 | mg/kg        |
| MH1E48    | 7/26/16     | RD2PWMN3 | RD2PWMN3     | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 4640   |                   | D*                    | mg/kg         | 0.5   | mg/kg        |
| MH1E49    | 7/26/16     | RD2PWMN4 | RD2PWMN4     | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 4340   |                   | D*                    | mg/kg         | 0.43  | mg/kg        |
| MH1E50    | 7/26/16     | RD2PWMN5 | RD2PWMN5     | ISM02.3           | 3050B             | 7439-96-5 | Manganese | 2070   |                   | D*                    | mg/kg         | 0.12  | mg/kg        |
| A8M5-6045 | 9/27/18     | RDAN9    | RDAN9-10     | EPA 200.2/200.7   | 200.2 - TR Metals | 7439-96-5 | Manganese | 627    | D                 | D                     | mg/kg dry wt  | 0.994 | mg/kg dry wt |
| A8M5-6046 | 9/27/18     | RDANCR21 | RDANCR21-10  | EPA 200.2/200.7   | 200.2 - TR Metals | 7439-96-5 | Manganese | 816    | D                 | D                     | mg/kg dry wt  | 1.01  | mg/kg dry wt |

**Panel C. ATV ABS Air - Alpine Loop (Follower)**

| Samp_No   | Sample Date | SampleTime | Location | Analytical Method | Extraction_Method    | CAS_NO    | Analyte   | Result  | Result_Qu alifier | Lab_Result _Qualifier | Result_Units      | Reporti ng_Limi t | Reporting_Li mit_Units |
|-----------|-------------|------------|----------|-------------------|----------------------|-----------|-----------|---------|-------------------|-----------------------|-------------------|-------------------|------------------------|
| A8M5-6436 | 9/27/18     | 13:05      | AL05F    | NIOSH 7300, MCE   | NIOSH 7300, MCE Prep | 7439-96-5 | Manganese | 0.00044 |                   |                       | mg/m <sup>3</sup> | 0.0002            | mg/m <sup>3</sup>      |
| A8M5-6435 | 9/27/18     | 13:05      | AL04F    | NIOSH 7300, MCE   | NIOSH 7300, MCE Prep | 7439-96-5 | Manganese | 0.00047 |                   |                       | mg/m <sup>3</sup> | 0.0002            | mg/m <sup>3</sup>      |
| A8M5-6434 | 9/27/18     | 13:05      | AL03F    | NIOSH 7300, MCE   | NIOSH 7300, MCE Prep | 7439-96-5 | Manganese | 0.00055 |                   |                       | mg/m <sup>3</sup> | 0.0002            | mg/m <sup>3</sup>      |
| A8M5-6426 | 9/26/18     | 12:00      | AL01F    | NIOSH 7300, MCE   | NIOSH 7300, MCE Prep | 7439-96-5 | Manganese | 0.00085 |                   |                       | mg/m <sup>3</sup> | 0.0005            | mg/m <sup>3</sup>      |
| A8M5-6428 | 9/26/18     | 13:32      | AL02F    | NIOSH 7300, MCE   | NIOSH 7300, MCE Prep | 7439-96-5 | Manganese | 0.0015  |                   |                       | mg/m <sup>3</sup> | 0.0005            | mg/m <sup>3</sup>      |

**Panel D. ATV ABS Air - Remote Loop (Follower)**

| Samp_No   | Sample Date | SampleTime | Location | Analytical Method | Extraction_Method    | CAS_NO    | Analyte   | Result    | Result_Qu alifier | Lab_Result _Qualifier | Result_Units      | Reporti ng_Limi t | Reporting_Li mit_Units |
|-----------|-------------|------------|----------|-------------------|----------------------|-----------|-----------|-----------|-------------------|-----------------------|-------------------|-------------------|------------------------|
| A8M5-6441 | 9/27/18     | 15:30      | RL06F    | NIOSH 7300, MCE   | NIOSH 7300, MCE Prep | 7439-96-5 | Manganese | 0.00051   |                   |                       | mg/m <sup>3</sup> | 0.0005            | mg/m <sup>3</sup>      |
| A8M5-6440 | 9/27/18     | 15:30      | RL05F    | NIOSH 7300, MCE   | NIOSH 7300, MCE Prep | 7439-96-5 | Manganese | 0.00053   |                   |                       | mg/m <sup>3</sup> | 0.0005            | mg/m <sup>3</sup>      |
| A8M5-6430 | 9/26/18     | 16:20      | RL01F    | NIOSH 7300, MCE   | NIOSH 7300, MCE Prep | 7439-96-5 | Manganese | 0.00086   |                   |                       | mg/m <sup>3</sup> | 0.0006            | mg/m <sup>3</sup>      |
| A8M5-6439 | 9/27/18     | 15:30      | RL04F    | NIOSH 7300, MCE   | NIOSH 7300, MCE Prep | 7439-96-5 | Manganese | [0.00044] | J                 | J                     | mg/m <sup>3</sup> | 0.0005            | mg/m <sup>3</sup>      |

# Appendix D

## Non-Lead Risk Calculations

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## APPENDIX D

### *Bonita Peak Mining District*

|            |                                                                   |
|------------|-------------------------------------------------------------------|
| TABLE D-1  | DETAILED RISK CALCULATIONS FOR THE ATV GUIDE IN EU5a              |
| TABLE D-2  | DETAILED RISK CALCULATIONS FOR THE ATV RECREATIONAL RIDER IN EU5b |
| TABLE D-3  | DETAILED RISK CALCULATIONS FOR THE HIKER IN EU1                   |
| TABLE D-4  | DETAILED RISK CALCULATIONS FOR THE HIKER IN EU2                   |
| TABLE D-5  | DETAILED RISK CALCULATIONS FOR THE HIKER IN EU3                   |
| TABLE D-6  | DETAILED RISK CALCULATIONS FOR THE HIKER IN EU4                   |
| TABLE D-7  | DETAILED RISK CALCULATIONS FOR THE CAMPER (USFS) IN EU6           |
| TABLE D-8  | DETAILED RISK CALCULATIONS FOR THE CAMPER (DISPERSED) IN EU7      |
| TABLE D-9  | DETAILED RISK CALCULATIONS FOR THE RECREATIONAL FISHERMAN IN EU8  |
| TABLE D-10 | DETAILED RISK CALCULATIONS FOR THE RECREATIONAL FISHERMAN IN EU9  |
| TABLE D-11 | DETAILED RISK CALCULATIONS FOR THE HUNTER IN EU1                  |
| TABLE D-12 | DETAILED RISK CALCULATIONS FOR THE HUNTER IN EU2                  |
| TABLE D-13 | DETAILED RISK CALCULATIONS FOR THE HUNTER IN EU3                  |
| TABLE D-14 | DETAILED RISK CALCULATIONS FOR THE HUNTER IN EU4                  |
| TABLE D-15 | DETAILED RISK CALCULATIONS FOR THE ROAD WORKER IN EU1             |
| TABLE D-16 | DETAILED RISK CALCULATIONS FOR THE ROAD WORKER IN EU2             |
| TABLE D-17 | DETAILED RISK CALCULATIONS FOR THE ROAD WORKER IN EU3             |
| TABLE D-18 | DETAILED RISK CALCULATIONS FOR THE ROAD WORKER IN EU4             |

#### **Footnotes:**

[a] All samples were non-detect.

[b] Low detection frequency; value shown is the maximum detected concentration.

[c] 95 UCL exceeded maximum concentration; value shown is the UCL.

[d] Samples were not analyzed for this chemical.

[e] One sample was analyzed; value shown is the detected concentration.

**TABLE D-1a**  
**DETAILED RISK CALCULATIONS FOR THE ATV GUIDE IN EU5a**  
*Bonita Peak Mining District*

**Panel A. CTE Scenario**

**Inhalation Caused by Human Disturbance**

| Chemical of Potential Concern * | Cair (mg/m <sup>3</sup> ) |     | Non Cancer Hazard |                         |              |       | Cancer Risk    |                         |                                        |      |
|---------------------------------|---------------------------|-----|-------------------|-------------------------|--------------|-------|----------------|-------------------------|----------------------------------------|------|
|                                 |                           |     | TWF (unitless)    | EC (mg/m <sup>3</sup> ) | iRfC (mg/kg) | HQ    | TWF (unitless) | EC (µg/m <sup>3</sup> ) | iUR (µg/m <sup>3</sup> ) <sup>-1</sup> | Risk |
| Antimony                        | --                        | [d] | 2.92E-03          | --                      | NA           | --    | 5.01E-04       | --                      | NA                                     | --   |
| Arsenic                         | --                        | [a] | 2.92E-03          | --                      | 1.50E-05     | --    | 5.01E-04       | --                      | 4.30E-03                               | --   |
| Cadmium                         | --                        | [a] | 2.92E-03          | --                      | 1.00E-05     | --    | 5.01E-04       | --                      | 1.80E-03                               | --   |
| Chromium(III)                   | --                        | [a] | 2.92E-03          | --                      | NA           | --    | 5.01E-04       | --                      | NA                                     | --   |
| Chromium(VI)                    | --                        | [a] | 2.92E-03          | --                      | 1.00E-04     | --    | 5.01E-04       | --                      | 8.40E-02                               | --   |
| Cobalt                          | --                        | [d] | 2.92E-03          | --                      | 6.00E-06     | --    | 5.01E-04       | --                      | 9.00E-03                               | --   |
| Iron                            | 1.46E-02                  |     | 2.92E-03          | 4.26E-05                | NA           | --    | 5.01E-04       | 1.1E-04                 | NA                                     | --   |
| Manganese                       | 7.62E-04                  |     | 2.92E-03          | 2.23E-06                | 5.00E-05     | 4E-02 | 5.01E-04       | 2.9E-07                 | NA                                     | --   |
| Thallium                        | --                        | [d] | 2.92E-03          | --                      | NA           | --    | 5.01E-04       | --                      | NA                                     | --   |
| Zinc                            | 2.13E-04                  |     | 2.92E-03          | 6.22E-07                | NA           | --    | 5.01E-04       | 2.3E-08                 | NA                                     | --   |

**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) |  | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|---------------|--|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |               |  |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | 2.45E+00      |  | 1.0            | 4.38E-08          | 1.1E-07      | 4.00E-04           | 3E-04 | 7.51E-09            | 1.8E-08      | NA                              | --    |
| Arsenic                         | 2.47E+01      |  | 0.08           | 4.38E-08          | 8.7E-08      | 3.00E-04           | 3E-04 | 7.51E-09            | 1.5E-08      | 1.50E+00                        | 2E-08 |
| Cadmium                         | 1.85E+00      |  | 1.0            | 4.38E-08          | 8.1E-08      | 1.00E-03           | 8E-05 | 7.51E-09            | 1.4E-08      | NA                              | --    |
| Chromium(III)                   | 4.80E+00      |  | 1.0            | 4.38E-08          | 2.1E-07      | 1.50E+00           | 1E-07 | 7.51E-09            | 3.6E-08      | NA                              | --    |
| Chromium(VI)                    | 5.33E-01      |  | 1.0            | 4.38E-08          | 2.3E-08      | 3.00E-03           | 8E-06 | 7.51E-09            | 4.0E-09      | 5.00E-01                        | 2E-09 |
| Cobalt                          | 6.54E+00      |  | 1.0            | 4.38E-08          | 2.9E-07      | 3.00E-04           | 1E-03 | 7.51E-09            | 4.9E-08      | NA                              | --    |
| Iron                            | 3.63E+04      |  | 1.0            | 4.38E-08          | 1.6E-03      | 7.00E-01           | 2E-03 | 7.51E-09            | 2.7E-04      | NA                              | --    |
| Manganese                       | 1.57E+03      |  | 1.0            | 4.38E-08          | 6.9E-05      | 2.40E-02           | 3E-03 | 7.51E-09            | 1.2E-05      | NA                              | --    |
| Thallium                        | 1.90E-01      |  | 1.0            | 4.38E-08          | 8.3E-09      | 1.00E-05           | 8E-04 | 7.51E-09            | 1.4E-09      | NA                              | --    |
| Zinc                            | 7.52E+02      |  | 1.0            | 4.38E-08          | 3.3E-05      | 3.00E-01           | 1E-04 | 7.51E-09            | 5.6E-06      | NA                              | --    |

**TABLE D-1a**  
**DETAILED RISK CALCULATIONS FOR THE ATV GUIDE IN EU5a**  
*Bonita Peak Mining District*

**Panel B. RME Scenario**

**Inhalation Caused by Human Disturbance**

| Chemical of Potential Concern * | Cair (mg/m <sup>3</sup> ) |     | Non Cancer Hazard |                         |              |       | Cancer Risk    |                         |                                        |      |
|---------------------------------|---------------------------|-----|-------------------|-------------------------|--------------|-------|----------------|-------------------------|----------------------------------------|------|
|                                 |                           |     | TWF (unitless)    | EC (mg/m <sup>3</sup> ) | iRfC (mg/kg) | HQ    | TWF (unitless) | EC (µg/m <sup>3</sup> ) | iUR (µg/m <sup>3</sup> ) <sup>-1</sup> | Risk |
| Antimony                        | --                        | [d] | 1.97E-02          | --                      | NA           | --    | 5.64E-03       | --                      | NA                                     | --   |
| Arsenic                         | --                        | [a] | 1.97E-02          | --                      | 1.50E-05     | --    | 5.64E-03       | --                      | 4.30E-03                               | --   |
| Cadmium                         | --                        | [a] | 1.97E-02          | --                      | 1.00E-05     | --    | 5.64E-03       | --                      | 1.80E-03                               | --   |
| Chromium(III)                   | --                        | [a] | 1.97E-02          | --                      | NA           | --    | 5.64E-03       | --                      | NA                                     | --   |
| Chromium(VI)                    | --                        | [a] | 1.97E-02          | --                      | 1.00E-04     | --    | 5.64E-03       | --                      | 8.40E-02                               | --   |
| Cobalt                          | --                        | [d] | 1.97E-02          | --                      | 6.00E-06     | --    | 5.64E-03       | --                      | 9.00E-03                               | --   |
| Iron                            | 1.46E-02                  |     | 1.97E-02          | 2.88E-04                | NA           | --    | 5.64E-03       | 1.2E-03                 | NA                                     | --   |
| Manganese                       | 7.62E-04                  |     | 1.97E-02          | 1.50E-05                | 5.00E-05     | 3E-01 | 5.64E-03       | 3.3E-06                 | NA                                     | --   |
| Thallium                        | --                        | [d] | 1.97E-02          | --                      | NA           | --    | 5.64E-03       | --                      | NA                                     | --   |
| Zinc                            | 2.13E-04                  |     | 1.97E-02          | 4.20E-06                | NA           | --    | 5.64E-03       | 2.6E-07                 | NA                                     | --   |

**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) |  | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|---------------|--|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |               |  |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | 2.45E+00      |  | 1.0            | 1.97E-07          | 4.8E-07      | 4.00E-04           | 1E-03 | 5.64E-08            | 1.4E-07      | NA                              | --    |
| Arsenic                         | 2.47E+01      |  | 0.08           | 1.97E-07          | 3.9E-07      | 3.00E-04           | 1E-03 | 5.64E-08            | 1.1E-07      | 1.50E+00                        | 2E-07 |
| Cadmium                         | 1.85E+00      |  | 1.0            | 1.97E-07          | 3.6E-07      | 1.00E-03           | 4E-04 | 5.64E-08            | 1.0E-07      | NA                              | --    |
| Chromium(III)                   | 4.80E+00      |  | 1.0            | 1.97E-07          | 9.5E-07      | 1.50E+00           | 6E-07 | 5.64E-08            | 2.7E-07      | NA                              | --    |
| Chromium(VI)                    | 5.33E-01      |  | 1.0            | 1.97E-07          | 1.1E-07      | 3.00E-03           | 4E-05 | 5.64E-08            | 3.0E-08      | 5.00E-01                        | 2E-08 |
| Cobalt                          | 6.54E+00      |  | 1.0            | 1.97E-07          | 1.3E-06      | 3.00E-04           | 4E-03 | 5.64E-08            | 3.7E-07      | NA                              | --    |
| Iron                            | 3.63E+04      |  | 1.0            | 1.97E-07          | 7.2E-03      | 7.00E-01           | 1E-02 | 5.64E-08            | 2.0E-03      | NA                              | --    |
| Manganese                       | 1.57E+03      |  | 1.0            | 1.97E-07          | 3.1E-04      | 2.40E-02           | 1E-02 | 5.64E-08            | 8.9E-05      | NA                              | --    |
| Thallium                        | 1.90E-01      |  | 1.0            | 1.97E-07          | 3.7E-08      | 1.00E-05           | 4E-03 | 5.64E-08            | 1.1E-08      | NA                              | --    |
| Zinc                            | 7.52E+02      |  | 1.0            | 1.97E-07          | 1.5E-04      | 3.00E-01           | 5E-04 | 5.64E-08            | 4.2E-05      | NA                              | --    |

\*The EPC values for chromium were assumed to be 10% hexavalent chromium and 90% trivalent chromium.

|                                |                                   |                            |
|--------------------------------|-----------------------------------|----------------------------|
| µg - microgram                 | kg = kilogram                     | SF = slope factor          |
| Cair = air concentration       | m = meter                         | TWF =time-weighting factor |
| Csoil = soil concentration     | mg = milligram                    | NA = not available         |
| CTE = cental tendency exposure | NC = non-cancer                   | -- = not calculated        |
| d = day                        | PEF = particulate emission factor |                            |
| DI = dietary intake            | RBA = relative bioavailability    |                            |
| EC = exposure concentration    | RfC = reference concentration     |                            |
| HIF = human intake factor      | RfD = reference dose              |                            |
| HQ = hazard quotient           | RME = reasonable maximum exposure |                            |

**TABLE D-1b**  
**RME RISK SUMMARY FOR THE ATV GUIDE**  
*Bonita Peak Mining District*

**Panel A: RME Non-Cancer Risks**

| Chemical of Potential Concern | Soil Inhalation | Incidental Soil Ingestion | Total HI     |
|-------------------------------|-----------------|---------------------------|--------------|
| Antimony                      | --              | 1E-03                     | 1E-03        |
| Arsenic                       | --              | 1E-03                     | 1E-03        |
| Cadmium                       | --              | 4E-04                     | 4E-04        |
| Chromium(III)                 | --              | 6E-07                     | 6E-07        |
| Chromium(VI)                  | --              | 4E-05                     | 4E-05        |
| Cobalt                        | --              | 4E-03                     | 4E-03        |
| Iron                          | --              | 1E-02                     | 1E-02        |
| Manganese                     | 3E-01           | 1E-02                     | 3E-01        |
| Thallium                      | --              | 4E-03                     | 4E-03        |
| Zinc                          | --              | 5E-04                     | 5E-04        |
| <b>Total</b>                  | <b>3E-01</b>    | <b>3E-02</b>              | <b>3E-01</b> |

**Panel B: RME Cancer Risks**

| Chemical of Potential Concern | Soil Inhalation | Incidental Soil Ingestion | Total Risk   |
|-------------------------------|-----------------|---------------------------|--------------|
| Antimony                      | --              | --                        | --           |
| Arsenic                       | --              | 2E-07                     | 2E-07        |
| Cadmium                       | --              | --                        | --           |
| Chromium(III)                 | --              | --                        | --           |
| Chromium(VI)                  | --              | 2E-08                     | 2E-08        |
| Cobalt                        | --              | --                        | --           |
| Iron                          | --              | --                        | --           |
| Manganese                     | --              | --                        | --           |
| Thallium                      | --              | --                        | --           |
| Zinc                          | --              | --                        | --           |
| <b>Total</b>                  | <b>0E+00</b>    | <b>2E-07</b>              | <b>2E-07</b> |

**Notes:**

-- = not calculated

HI = hazard index

RME = reasonable maximum exposure

**TABLE D-2a**  
**DETAILED RISK CALCULATIONS FOR THE ATV REC IN EU5b**  
*Bonita Peak Mining District*

**Panel A. CTE Scenario**  
**Inhalation Caused by Human Disturbance**

| Chemical of Potential Concern * | Csoil (mg/kg) | RBA (unitless) | PEF (kg/m <sup>3</sup> ) | Cair (mg/m <sup>3</sup> ) | Non Cancer Hazard |                         |              |       | Cancer Risk    |                         |                                        |       |
|---------------------------------|---------------|----------------|--------------------------|---------------------------|-------------------|-------------------------|--------------|-------|----------------|-------------------------|----------------------------------------|-------|
|                                 |               |                |                          |                           | TWF (unitless)    | EC (mg/m <sup>3</sup> ) | iRfC (mg/kg) | HQ    | TWF (unitless) | EC (µg/m <sup>3</sup> ) | iUR (µg/m <sup>3</sup> ) <sup>-1</sup> | Risk  |
| Antimony                        | 1.60E+01      | 1.0            | 5.60E-07                 | 8.98E-06                  | 3.65E-03          | 3.28E-08                | NA           | --    | 6.26E-04       | 5.6E-06                 | NA                                     | --    |
| Arsenic                         | 4.69E+01      | 1.0            | 5.60E-07                 | 2.63E-05                  | 3.65E-03          | 9.60E-08                | 1.50E-05     | 6E-03 | 6.26E-04       | 1.6E-05                 | 4.30E-03                               | 7E-08 |
| Cadmium                         | 5.12E+00      | 1.0            | 5.60E-07                 | 2.87E-06                  | 3.65E-03          | 1.05E-08                | 1.00E-05     | 1E-03 | 6.26E-04       | 1.8E-06                 | 1.80E-03                               | 3E-09 |
| Chromium(III)                   | 4.63E+00      | 1.0            | 5.60E-07                 | 2.59E-06                  | 3.65E-03          | 9.46E-09                | NA           | --    | 6.26E-04       | 1.6E-06                 | NA                                     | --    |
| Chromium(VI)                    | 5.14E-01      | 1.0            | 5.60E-07                 | 2.88E-07                  | 3.65E-03          | 1.05E-09                | 1.00E-04     | 1E-05 | 6.26E-04       | 1.8E-07                 | 8.40E-02                               | 3E-08 |
| Cobalt                          | 8.55E+00      | 1.0            | 5.60E-07                 | 4.79E-06                  | 3.65E-03          | 1.75E-08                | 6.00E-06     | 3E-03 | 6.26E-04       | 3.0E-06                 | 9.00E-03                               | 3E-08 |
| Iron                            | 3.18E+04      | 1.0            | 5.60E-07                 | 1.78E-02                  | 3.65E-03          | 6.50E-05                | NA           | --    | 6.26E-04       | 1.1E-02                 | NA                                     | --    |
| Manganese                       | 4.43E+03      | 1.0            | 5.60E-07                 | 2.48E-03                  | 3.65E-03          | 9.06E-06                | 5.00E-05     | 2E-01 | 6.26E-04       | 1.6E-03                 | NA                                     | --    |
| Thallium                        | 6.14E-01      | 1.0            | 5.60E-07                 | 3.44E-07                  | 3.65E-03          | 1.26E-09                | NA           | --    | 6.26E-04       | 2.2E-07                 | NA                                     | --    |
| Zinc                            | 1.06E+03      | 1.0            | 5.60E-07                 | 5.91E-04                  | 3.65E-03          | 2.16E-06                | NA           | --    | 6.26E-04       | 3.7E-04                 | NA                                     | --    |

**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|---------------|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |               |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | 1.60E+01      | 1.0            | 7.72E-08          | 1.2E-06      | 4.00E-04           | 3E-03 | 1.32E-08            | 2.1E-07      | NA                              | --    |
| Arsenic                         | 4.69E+01      | 0.08           | 7.72E-08          | 2.9E-07      | 3.00E-04           | 1E-03 | 1.32E-08            | 5.0E-08      | 1.50E+00                        | 7E-08 |
| Cadmium                         | 5.12E+00      | 1.0            | 7.72E-08          | 4.0E-07      | 1.00E-03           | 4E-04 | 1.32E-08            | 6.8E-08      | NA                              | --    |
| Chromium(III)                   | 4.63E+00      | 1.0            | 7.72E-08          | 3.6E-07      | 1.50E+00           | 2E-07 | 1.32E-08            | 6.1E-08      | NA                              | --    |
| Chromium(VI)                    | 5.14E-01      | 1.0            | 7.72E-08          | 4.0E-08      | 3.00E-03           | 1E-05 | 1.32E-08            | 6.8E-09      | 5.00E-01                        | 7E-09 |
| Cobalt                          | 8.55E+00      | 1.0            | 7.72E-08          | 6.6E-07      | 3.00E-04           | 2E-03 | 1.32E-08            | 1.1E-07      | NA                              | --    |
| Iron                            | 3.18E+04      | 1.0            | 7.72E-08          | 2.5E-03      | 7.00E-01           | 4E-03 | 1.32E-08            | 4.2E-04      | NA                              | --    |
| Manganese                       | 4.43E+03      | 1.0            | 7.72E-08          | 3.4E-04      | 2.40E-02           | 1E-02 | 1.32E-08            | 5.9E-05      | NA                              | --    |
| Thallium                        | 6.14E-01      | 1.0            | 7.72E-08          | 4.7E-08      | 1.00E-05           | 5E-03 | 1.32E-08            | 8.1E-09      | NA                              | --    |
| Zinc                            | 1.06E+03      | 1.0            | 7.72E-08          | 8.2E-05      | 3.00E-01           | 3E-04 | 1.32E-08            | 1.4E-05      | NA                              | --    |

**TABLE D-2a**  
**DETAILED RISK CALCULATIONS FOR THE ATV REC IN EU5b**  
*Bonita Peak Mining District*

**Panel B. RME Scenario**  
**Inhalation Caused by Human Disturbance**

| Chemical of Potential Concern * | Csoil (mg/kg) | RBA (unitless) | PEF (kg/m <sup>3</sup> ) | Cair (mg/m <sup>3</sup> ) | Non Cancer Hazard |                         |              |       | Cancer Risk    |                         |                                        |       |
|---------------------------------|---------------|----------------|--------------------------|---------------------------|-------------------|-------------------------|--------------|-------|----------------|-------------------------|----------------------------------------|-------|
|                                 |               |                |                          |                           | TWF (unitless)    | EC (mg/m <sup>3</sup> ) | iRfC (mg/kg) | HQ    | TWF (unitless) | EC (µg/m <sup>3</sup> ) | iUR (µg/m <sup>3</sup> ) <sup>-1</sup> | Risk  |
| Antimony                        | 1.60E+01      | 1.0            | 5.60E-07                 | 8.98E-06                  | 1.64E-02          | 1.48E-07                | NA           | --    | 4.70E-03       | 4.2E-05                 | NA                                     | --    |
| Arsenic                         | 4.69E+01      | 1.0            | 5.60E-07                 | 2.63E-05                  | 1.64E-02          | 4.32E-07                | 1.50E-05     | 3E-02 | 4.70E-03       | 1.2E-04                 | 4.30E-03                               | 5E-07 |
| Cadmium                         | 5.12E+00      | 1.0            | 5.60E-07                 | 2.87E-06                  | 1.64E-02          | 4.71E-08                | 1.00E-05     | 5E-03 | 4.70E-03       | 1.3E-05                 | 1.80E-03                               | 2E-08 |
| Chromium(III)                   | 4.63E+00      | 1.0            | 5.60E-07                 | 2.59E-06                  | 1.64E-02          | 4.26E-08                | NA           | --    | 4.70E-03       | 1.2E-05                 | NA                                     | --    |
| Chromium(VI)                    | 5.14E-01      | 1.0            | 5.60E-07                 | 2.88E-07                  | 1.64E-02          | 4.73E-09                | 1.00E-04     | 5E-05 | 4.70E-03       | 1.4E-06                 | 8.40E-02                               | 2E-07 |
| Cobalt                          | 8.55E+00      | 1.0            | 5.60E-07                 | 4.79E-06                  | 1.64E-02          | 7.87E-08                | 6.00E-06     | 1E-02 | 4.70E-03       | 2.2E-05                 | 9.00E-03                               | 2E-07 |
| Iron                            | 3.18E+04      | 1.0            | 5.60E-07                 | 1.78E-02                  | 1.64E-02          | 2.93E-04                | NA           | --    | 4.70E-03       | 8.4E-02                 | NA                                     | --    |
| Manganese                       | 4.43E+03      | 1.0            | 5.60E-07                 | 2.48E-03                  | 1.64E-02          | 4.08E-05                | 5.00E-05     | 8E-01 | 4.70E-03       | 1.2E-02                 | NA                                     | --    |
| Thallium                        | 6.14E-01      | 1.0            | 5.60E-07                 | 3.44E-07                  | 1.64E-02          | 5.65E-09                | NA           | --    | 4.70E-03       | 1.6E-06                 | NA                                     | --    |
| Zinc                            | 1.06E+03      | 1.0            | 5.60E-07                 | 5.91E-04                  | 1.64E-02          | 9.72E-06                | NA           | --    | 4.70E-03       | 2.8E-03                 | NA                                     | --    |

**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|---------------|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |               |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | 1.60E+01      | 1.0            | 3.09E-07          | 5.0E-06      | 4.00E-04           | 1E-02 | 8.82E-08            | 1.4E-06      | NA                              | --    |
| Arsenic                         | 4.69E+01      | 0.08           | 3.09E-07          | 1.2E-06      | 3.00E-04           | 4E-03 | 8.82E-08            | 3.3E-07      | 1.50E+00                        | 5E-07 |
| Cadmium                         | 5.12E+00      | 1.0            | 3.09E-07          | 1.6E-06      | 1.00E-03           | 2E-03 | 8.82E-08            | 4.5E-07      | NA                              | --    |
| Chromium(III)                   | 4.63E+00      | 1.0            | 3.09E-07          | 1.4E-06      | 1.50E+00           | 1E-06 | 8.82E-08            | 4.1E-07      | NA                              | --    |
| Chromium(VI)                    | 5.14E-01      | 1.0            | 3.09E-07          | 1.6E-07      | 3.00E-03           | 5E-05 | 8.82E-08            | 4.5E-08      | 5.00E-01                        | 5E-08 |
| Cobalt                          | 8.55E+00      | 1.0            | 3.09E-07          | 2.6E-06      | 3.00E-04           | 9E-03 | 8.82E-08            | 7.5E-07      | NA                              | --    |
| Iron                            | 3.18E+04      | 1.0            | 3.09E-07          | 9.8E-03      | 7.00E-01           | 1E-02 | 8.82E-08            | 2.8E-03      | NA                              | --    |
| Manganese                       | 4.43E+03      | 1.0            | 3.09E-07          | 1.4E-03      | 2.40E-02           | 6E-02 | 8.82E-08            | 3.9E-04      | NA                              | --    |
| Thallium                        | 6.14E-01      | 1.0            | 3.09E-07          | 1.9E-07      | 1.00E-05           | 2E-02 | 8.82E-08            | 5.4E-08      | NA                              | --    |
| Zinc                            | 1.06E+03      | 1.0            | 3.09E-07          | 3.3E-04      | 3.00E-01           | 1E-03 | 8.82E-08            | 9.3E-05      | NA                              | --    |

\*The EPC values for chromium were assumed to be 10% hexavalent chromium and 90% trivalent chromium.

µg - microgram  
 Cair = air concentration  
 Csoil = soil concentration  
 CTE = central tendency exposure  
 d = day  
 DI = dietary intake  
 EC = exposure concentration  
 HIF = human intake factor  
 HQ = hazard quotient

kg = kilogram  
 m = meter  
 mg = milligram  
 NC = non-cancer  
 PEF = particulate emission factor  
 RBA = relative bioavailability  
 RfC = reference concentration  
 RfD = reference dose  
 RME = reasonable maximum exposure

SF = slope factor  
 TWF = time-weighting factor  
 NA = not available  
 -- = not calculated

**TABLE D-2b**  
**RME RISK SUMMARY FOR THE ATV REC**  
*Bonita Peak Mining District*

**Panel A: RME Non-Cancer Risks**

| Chemical of Potential Concern | Soil Inhalation | Incidental Soil Ingestion | Total HI     |
|-------------------------------|-----------------|---------------------------|--------------|
| Antimony                      | --              | 1E-02                     | 1E-02        |
| Arsenic                       | 3E-02           | 4E-03                     | 3E-02        |
| Cadmium                       | 5E-03           | 2E-03                     | 6E-03        |
| Chromium(III)                 | --              | 1E-06                     | 1E-06        |
| Chromium(VI)                  | 5E-05           | 5E-05                     | 1E-04        |
| Cobalt                        | 1E-02           | 9E-03                     | 2E-02        |
| Iron                          | --              | 1E-02                     | 1E-02        |
| Manganese                     | 8E-01           | 6E-02                     | 9E-01        |
| Thallium                      | --              | 2E-02                     | 2E-02        |
| Zinc                          | --              | 1E-03                     | 1E-03        |
| <b>Total</b>                  | <b>9E-01</b>    | <b>1E-01</b>              | <b>1E+00</b> |

**Panel B: RME Cancer Risks**

| Chemical of Potential Concern | Soil Inhalation | Incidental Soil Ingestion | Total Risk   |
|-------------------------------|-----------------|---------------------------|--------------|
| Antimony                      | --              | --                        | --           |
| Arsenic                       | 5E-07           | 5E-07                     | 1E-06        |
| Cadmium                       | 2E-08           | --                        | 2E-08        |
| Chromium(III)                 | --              | --                        | --           |
| Chromium(VI)                  | 2E-07           | 5E-08                     | 3E-07        |
| Cobalt                        | 2E-07           | --                        | 2E-07        |
| Iron                          | --              | --                        | --           |
| Manganese                     | --              | --                        | --           |
| Thallium                      | --              | --                        | --           |
| Zinc                          | --              | --                        | --           |
| <b>Total</b>                  | <b>1E-06</b>    | <b>5E-07</b>              | <b>2E-06</b> |

**Notes:**

-- = not calculated

HI = hazard index

RME = reasonable maximum exposure

**TABLE D-3a**  
**DETAILED RISK CALCULATIONS FOR THE HIKER IN EU1**  
*Bonita Peak Mining District*

**Panel A. CTE Scenario**  
**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                |       |
|---------------------------------|---------------|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|--------------------------------|-------|
|                                 |               |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>1</sup> | Risk  |
| Antimony                        | 2.85E+00      | 1.0            | 7.72E-08          | 2.2E-07      | 4.00E-04           | 5E-04 | 1.32E-08            | 3.8E-08      | NA                             | --    |
| Arsenic                         | 4.28E+01      | **             | 7.72E-08          | 3.3E-06      | 3.00E-04           | 1E-02 | 1.32E-08            | 5.7E-07      | 1.50E+00                       | 8E-07 |
| Cadmium                         | 1.42E+01      | 1.0            | 7.72E-08          | 1.1E-06      | 1.00E-03           | 1E-03 | 1.32E-08            | 1.9E-07      | NA                             | --    |
| Chromium(III)                   | 2.65E+00      | 1.0            | 7.72E-08          | 2.0E-07      | 1.50E+00           | 1E-07 | 1.32E-08            | 3.5E-08      | NA                             | --    |
| Chromium(VI)                    | 2.95E-01      | 1.0            | 7.72E-08          | 2.3E-08      | 3.00E-03           | 8E-06 | 1.32E-08            | 3.9E-09      | 5.00E-01                       | 4E-09 |
| Cobalt                          | 9.79E+00      | 1.0            | 7.72E-08          | 7.6E-07      | 3.00E-04           | 3E-03 | 1.32E-08            | 1.3E-07      | NA                             | --    |
| Iron                            | 2.02E+04      | 1.0            | 7.72E-08          | 1.6E-03      | 7.00E-01           | 2E-03 | 1.32E-08            | 2.7E-04      | NA                             | --    |
| Manganese                       | 5.89E+03      | 1.0            | 7.72E-08          | 4.5E-04      | 2.40E-02           | 2E-02 | 1.32E-08            | 7.8E-05      | NA                             | --    |
| Thallium                        | 3.68E-01      | 1.0            | 7.72E-08          | 2.8E-08      | 1.00E-05           | 3E-03 | 1.32E-08            | 4.9E-09      | NA                             | --    |
| Zinc                            | 1.12E+03      | 1.0            | 7.72E-08          | 8.7E-05      | 3.00E-01           | 3E-04 | 1.32E-08            | 1.5E-05      | NA                             | --    |

**Panel B. RME Scenario**  
**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                |       |
|---------------------------------|---------------|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|--------------------------------|-------|
|                                 |               |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>1</sup> | Risk  |
| Antimony                        | 2.85E+00      | 1.0            | 3.09E-07          | 8.8E-07      | 4.00E-04           | 2E-03 | 8.82E-08            | 2.5E-07      | NA                             | --    |
| Arsenic                         | 4.28E+01      | **             | 3.09E-07          | 1.3E-05      | 3.00E-04           | 4E-02 | 8.82E-08            | 3.8E-06      | 1.50E+00                       | 6E-06 |
| Cadmium                         | 1.42E+01      | 1.0            | 3.09E-07          | 4.4E-06      | 1.00E-03           | 4E-03 | 8.82E-08            | 1.2E-06      | NA                             | --    |
| Chromium(III)                   | 2.65E+00      | 1.0            | 3.09E-07          | 8.2E-07      | 1.50E+00           | 5E-07 | 8.82E-08            | 2.3E-07      | NA                             | --    |
| Chromium(VI)                    | 2.95E-01      | 1.0            | 3.09E-07          | 9.1E-08      | 3.00E-03           | 3E-05 | 8.82E-08            | 2.6E-08      | 5.00E-01                       | 3E-08 |
| Cobalt                          | 9.79E+00      | 1.0            | 3.09E-07          | 3.0E-06      | 3.00E-04           | 1E-02 | 8.82E-08            | 8.6E-07      | NA                             | --    |
| Iron                            | 2.02E+04      | 1.0            | 3.09E-07          | 6.2E-03      | 7.00E-01           | 9E-03 | 8.82E-08            | 1.8E-03      | NA                             | --    |
| Manganese                       | 5.89E+03      | 1.0            | 3.09E-07          | 1.8E-03      | 2.40E-02           | 8E-02 | 8.82E-08            | 5.2E-04      | NA                             | --    |
| Thallium                        | 3.68E-01      | 1.0            | 3.09E-07          | 1.1E-07      | 1.00E-05           | 1E-02 | 8.82E-08            | 3.2E-08      | NA                             | --    |
| Zinc                            | 1.12E+03      | 1.0            | 3.09E-07          | 3.5E-04      | 3.00E-01           | 1E-03 | 8.82E-08            | 9.9E-05      | NA                             | --    |

\*The EPC values for chromium were assumed to be 10% hexavalent chromium and 90% trivalent chromium.  
 \*\*The EPC value for arsenic represents the time-weighted concentration, adjusted for the soil-specific RBA for waste rock (0.06) and overbank (0.60)

|                                 |                           |                                |                                   |
|---------------------------------|---------------------------|--------------------------------|-----------------------------------|
| Csoil = soil concentration      | HIF = human intake factor | NC = non-cancer                | RME = reasonable maximum exposure |
| CTE = central tendency exposure | HQ = hazard quotient      | RBA = relative bioavailability | SF = slope factor                 |
| d = day                         | kg = kilogram             | RfC = reference concentration  | NA = not available                |
| DI = dietary intake             | mg = milligram            | RfD = reference dose           | -- = not calculated               |

**TABLE D-4a**  
**DETAILED RISK CALCULATIONS FOR THE HIKER IN EU2**  
*Bonita Peak Mining District*

**Panel A. CTE Scenario**  
**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                |       |
|---------------------------------|---------------|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|--------------------------------|-------|
|                                 |               |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>1</sup> | Risk  |
| Antimony                        | 1.49E+01      | 1.0            | 7.72E-08          | 1.1E-06      | 4.00E-04           | 3E-03 | 1.32E-08            | 2.0E-07      | NA                             | --    |
| Arsenic                         | 2.20E+01      | **             | 7.72E-08          | 1.7E-06      | 3.00E-04           | 6E-03 | 1.32E-08            | 2.9E-07      | 1.50E+00                       | 4E-07 |
| Cadmium                         | 4.90E+00      | 1.0            | 7.72E-08          | 3.8E-07      | 1.00E-03           | 4E-04 | 1.32E-08            | 6.5E-08      | NA                             | --    |
| Chromium(III)                   | 2.84E+00      | 1.0            | 7.72E-08          | 2.2E-07      | 1.50E+00           | 1E-07 | 1.32E-08            | 3.8E-08      | NA                             | --    |
| Chromium(VI)                    | 3.16E-01      | 1.0            | 7.72E-08          | 2.4E-08      | 3.00E-03           | 8E-06 | 1.32E-08            | 4.2E-09      | 5.00E-01                       | 4E-09 |
| Cobalt                          | 7.17E+00      | 1.0            | 7.72E-08          | 5.5E-07      | 3.00E-04           | 2E-03 | 1.32E-08            | 9.5E-08      | NA                             | --    |
| Iron                            | 2.21E+04      | 1.0            | 7.72E-08          | 1.7E-03      | 7.00E-01           | 2E-03 | 1.32E-08            | 2.9E-04      | NA                             | --    |
| Manganese                       | 6.52E+03      | 1.0            | 7.72E-08          | 5.0E-04      | 2.40E-02           | 2E-02 | 1.32E-08            | 8.6E-05      | NA                             | --    |
| Thallium                        | 2.33E-01      | 1.0            | 7.72E-08          | 1.8E-08      | 1.00E-05           | 2E-03 | 1.32E-08            | 3.1E-09      | NA                             | --    |
| Zinc                            | 1.35E+03      | 1.0            | 7.72E-08          | 1.0E-04      | 3.00E-01           | 3E-04 | 1.32E-08            | 1.8E-05      | NA                             | --    |

**Panel B. RME Scenario**  
**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                |       |
|---------------------------------|---------------|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|--------------------------------|-------|
|                                 |               |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>1</sup> | Risk  |
| Antimony                        | 1.49E+01      | 1.0            | 3.09E-07          | 4.6E-06      | 4.00E-04           | 1E-02 | 8.82E-08            | 1.3E-06      | NA                             | --    |
| Arsenic                         | 2.20E+01      | **             | 3.09E-07          | 6.8E-06      | 3.00E-04           | 2E-02 | 8.82E-08            | 1.9E-06      | 1.50E+00                       | 3E-06 |
| Cadmium                         | 4.90E+00      | 1.0            | 3.09E-07          | 1.5E-06      | 1.00E-03           | 2E-03 | 8.82E-08            | 4.3E-07      | NA                             | --    |
| Chromium(III)                   | 2.84E+00      | 1.0            | 3.09E-07          | 8.8E-07      | 1.50E+00           | 6E-07 | 8.82E-08            | 2.5E-07      | NA                             | --    |
| Chromium(VI)                    | 3.16E-01      | 1.0            | 3.09E-07          | 9.8E-08      | 3.00E-03           | 3E-05 | 8.82E-08            | 2.8E-08      | 5.00E-01                       | 3E-08 |
| Cobalt                          | 7.17E+00      | 1.0            | 3.09E-07          | 2.2E-06      | 3.00E-04           | 7E-03 | 8.82E-08            | 6.3E-07      | NA                             | --    |
| Iron                            | 2.21E+04      | 1.0            | 3.09E-07          | 6.8E-03      | 7.00E-01           | 1E-02 | 8.82E-08            | 1.9E-03      | NA                             | --    |
| Manganese                       | 6.52E+03      | 1.0            | 3.09E-07          | 2.0E-03      | 2.40E-02           | 8E-02 | 8.82E-08            | 5.8E-04      | NA                             | --    |
| Thallium                        | 2.33E-01      | 1.0            | 3.09E-07          | 7.2E-08      | 1.00E-05           | 7E-03 | 8.82E-08            | 2.1E-08      | NA                             | --    |
| Zinc                            | 1.35E+03      | 1.0            | 3.09E-07          | 4.2E-04      | 3.00E-01           | 1E-03 | 8.82E-08            | 1.2E-04      | NA                             | --    |

\*The EPC values for chromium were assumed to be 10% hexavalent chromium and 90% trivalent chromium.  
 \*\*The EPC value for arsenic represents the time-weighted concentration, adjusted for the soil-specific RBA for waste rock (0.06) and overbank (0.60)

|                                 |                           |                                |                                   |
|---------------------------------|---------------------------|--------------------------------|-----------------------------------|
| Csoil = soil concentration      | HIF = human intake factor | NC = non-cancer                | RME = reasonable maximum exposure |
| CTE = central tendency exposure | HQ = hazard quotient      | RBA = relative bioavailability | SF = slope factor                 |
| d = day                         | kg = kilogram             | RfC = reference concentration  | NA = not available                |
| DI = dietary intake             | mg = milligram            | RfD = reference dose           | -- = not calculated               |

**TABLE D-5a**  
**DETAILED RISK CALCULATIONS FOR THE HIKER IN EU3**  
*Bonita Peak Mining District*

**Panel A. CTE Scenario**  
**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                |       |
|---------------------------------|---------------|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|--------------------------------|-------|
|                                 |               |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>1</sup> | Risk  |
| Antimony                        | 1.76E+00      | 1.0            | 7.72E-08          | 1.4E-07      | 4.00E-04           | 3E-04 | 1.32E-08            | 2.3E-08      | NA                             | --    |
| Arsenic                         | 2.30E+01      | **             | 7.72E-08          | 1.8E-06      | 3.00E-04           | 6E-03 | 1.32E-08            | 3.0E-07      | 1.50E+00                       | 5E-07 |
| Cadmium                         | 4.02E+00      | 1.0            | 7.72E-08          | 3.1E-07      | 1.00E-03           | 3E-04 | 1.32E-08            | 5.3E-08      | NA                             | --    |
| Chromium(III)                   | 2.73E+00      | 1.0            | 7.72E-08          | 2.1E-07      | 1.50E+00           | 1E-07 | 1.32E-08            | 3.6E-08      | NA                             | --    |
| Chromium(VI)                    | 3.03E-01      | 1.0            | 7.72E-08          | 2.3E-08      | 3.00E-03           | 8E-06 | 1.32E-08            | 4.0E-09      | 5.00E-01                       | 4E-09 |
| Cobalt                          | 4.96E+00      | 1.0            | 7.72E-08          | 3.8E-07      | 3.00E-04           | 1E-03 | 1.32E-08            | 6.6E-08      | NA                             | --    |
| Iron                            | 3.03E+04      | 1.0            | 7.72E-08          | 2.3E-03      | 7.00E-01           | 3E-03 | 1.32E-08            | 4.0E-04      | NA                             | --    |
| Manganese                       | 1.54E+03      | 1.0            | 7.72E-08          | 1.2E-04      | 2.40E-02           | 5E-03 | 1.32E-08            | 2.0E-05      | NA                             | --    |
| Thallium                        | 5.43E-01      | 1.0            | 7.72E-08          | 4.2E-08      | 1.00E-05           | 4E-03 | 1.32E-08            | 7.2E-09      | NA                             | --    |
| Zinc                            | 6.69E+02      | 1.0            | 7.72E-08          | 5.2E-05      | 3.00E-01           | 2E-04 | 1.32E-08            | 8.9E-06      | NA                             | --    |

**Panel B. RME Scenario**  
**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                |       |
|---------------------------------|---------------|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|--------------------------------|-------|
|                                 |               |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>1</sup> | Risk  |
| Antimony                        | 1.76E+00      | 1.0            | 3.09E-07          | 5.4E-07      | 4.00E-04           | 1E-03 | 8.82E-08            | 1.6E-07      | NA                             | --    |
| Arsenic                         | 2.30E+01      | **             | 3.09E-07          | 7.1E-06      | 3.00E-04           | 2E-02 | 8.82E-08            | 2.0E-06      | 1.50E+00                       | 3E-06 |
| Cadmium                         | 4.02E+00      | 1.0            | 3.09E-07          | 1.2E-06      | 1.00E-03           | 1E-03 | 8.82E-08            | 3.5E-07      | NA                             | --    |
| Chromium(III)                   | 2.73E+00      | 1.0            | 3.09E-07          | 8.4E-07      | 1.50E+00           | 6E-07 | 8.82E-08            | 2.4E-07      | NA                             | --    |
| Chromium(VI)                    | 3.03E-01      | 1.0            | 3.09E-07          | 9.4E-08      | 3.00E-03           | 3E-05 | 8.82E-08            | 2.7E-08      | 5.00E-01                       | 3E-08 |
| Cobalt                          | 4.96E+00      | 1.0            | 3.09E-07          | 1.5E-06      | 3.00E-04           | 5E-03 | 8.82E-08            | 4.4E-07      | NA                             | --    |
| Iron                            | 3.03E+04      | 1.0            | 3.09E-07          | 9.4E-03      | 7.00E-01           | 1E-02 | 8.82E-08            | 2.7E-03      | NA                             | --    |
| Manganese                       | 1.54E+03      | 1.0            | 3.09E-07          | 4.8E-04      | 2.40E-02           | 2E-02 | 8.82E-08            | 1.4E-04      | NA                             | --    |
| Thallium                        | 5.43E-01      | 1.0            | 3.09E-07          | 1.7E-07      | 1.00E-05           | 2E-02 | 8.82E-08            | 4.8E-08      | NA                             | --    |
| Zinc                            | 6.69E+02      | 1.0            | 3.09E-07          | 2.1E-04      | 3.00E-01           | 7E-04 | 8.82E-08            | 5.9E-05      | NA                             | --    |

\*The EPC values for chromium were assumed to be 10% hexavalent chromium and 90% trivalent chromium.  
 \*\*The EPC value for arsenic represents the time-weighted concentration, adjusted for the soil-specific RBA for waste rock (0.06) and overbank (0.60)

|                                 |                           |                                |                                   |
|---------------------------------|---------------------------|--------------------------------|-----------------------------------|
| Csoil = soil concentration      | HIF = human intake factor | NC = non-cancer                | RME = reasonable maximum exposure |
| CTE = central tendency exposure | HQ = hazard quotient      | RBA = relative bioavailability | SF = slope factor                 |
| d = day                         | kg = kilogram             | RfC = reference concentration  | NA = not available                |
| DI = dietary intake             | mg = milligram            | RfD = reference dose           | -- = not calculated               |

**TABLE D-6a**  
**DETAILED RISK CALCULATIONS FOR THE HIKER IN EU4**  
*Bonita Peak Mining District*

**Panel A. CTE Scenario**  
**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                |       |
|---------------------------------|---------------|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|--------------------------------|-------|
|                                 |               |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>1</sup> | Risk  |
| Antimony                        | 1.83E+00      | 1.0            | 7.72E-08          | 1.4E-07      | 4.00E-04           | 4E-04 | 1.32E-08            | 2.4E-08      | NA                             | --    |
| Arsenic                         | 9.27E+01      | **             | 7.72E-08          | 7.2E-06      | 3.00E-04           | 2E-02 | 1.32E-08            | 1.2E-06      | 1.50E+00                       | 2E-06 |
| Cadmium                         | 2.60E+00      | 1.0            | 7.72E-08          | 2.0E-07      | 1.00E-03           | 2E-04 | 1.32E-08            | 3.4E-08      | NA                             | --    |
| Chromium(III)                   | 2.35E+00      | 1.0            | 7.72E-08          | 1.8E-07      | 1.50E+00           | 1E-07 | 1.32E-08            | 3.1E-08      | NA                             | --    |
| Chromium(VI)                    | 2.61E-01      | 1.0            | 7.72E-08          | 2.0E-08      | 3.00E-03           | 7E-06 | 1.32E-08            | 3.4E-09      | 5.00E-01                       | 3E-09 |
| Cobalt                          | 8.73E+00      | 1.0            | 7.72E-08          | 6.7E-07      | 3.00E-04           | 2E-03 | 1.32E-08            | 1.2E-07      | NA                             | --    |
| Iron                            | 3.39E+04      | 1.0            | 7.72E-08          | 2.6E-03      | 7.00E-01           | 4E-03 | 1.32E-08            | 4.5E-04      | NA                             | --    |
| Manganese                       | 1.40E+03      | 1.0            | 7.72E-08          | 1.1E-04      | 2.40E-02           | 5E-03 | 1.32E-08            | 1.9E-05      | NA                             | --    |
| Thallium                        | 7.28E-02      | 1.0            | 7.72E-08          | 5.6E-09      | 1.00E-05           | 6E-04 | 1.32E-08            | 9.6E-10      | NA                             | --    |
| Zinc                            | 5.59E+02      | 1.0            | 7.72E-08          | 4.3E-05      | 3.00E-01           | 1E-04 | 1.32E-08            | 7.4E-06      | NA                             | --    |

**Panel B. RME Scenario**  
**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                |       |
|---------------------------------|---------------|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|--------------------------------|-------|
|                                 |               |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>1</sup> | Risk  |
| Antimony                        | 1.83E+00      | 1.0            | 3.09E-07          | 5.7E-07      | 4.00E-04           | 1E-03 | 8.82E-08            | 1.6E-07      | NA                             | --    |
| Arsenic                         | 9.27E+01      | **             | 3.09E-07          | 2.9E-05      | 3.00E-04           | 1E-01 | 8.82E-08            | 8.2E-06      | 1.50E+00                       | 1E-05 |
| Cadmium                         | 2.60E+00      | 1.0            | 3.09E-07          | 8.0E-07      | 1.00E-03           | 8E-04 | 8.82E-08            | 2.3E-07      | NA                             | --    |
| Chromium(III)                   | 2.35E+00      | 1.0            | 3.09E-07          | 7.2E-07      | 1.50E+00           | 5E-07 | 8.82E-08            | 2.1E-07      | NA                             | --    |
| Chromium(VI)                    | 2.61E-01      | 1.0            | 3.09E-07          | 8.0E-08      | 3.00E-03           | 3E-05 | 8.82E-08            | 2.3E-08      | 5.00E-01                       | 2E-08 |
| Cobalt                          | 8.73E+00      | 1.0            | 3.09E-07          | 2.7E-06      | 3.00E-04           | 9E-03 | 8.82E-08            | 7.7E-07      | NA                             | --    |
| Iron                            | 3.39E+04      | 1.0            | 3.09E-07          | 1.0E-02      | 7.00E-01           | 1E-02 | 8.82E-08            | 3.0E-03      | NA                             | --    |
| Manganese                       | 1.40E+03      | 1.0            | 3.09E-07          | 4.3E-04      | 2.40E-02           | 2E-02 | 8.82E-08            | 1.2E-04      | NA                             | --    |
| Thallium                        | 7.28E-02      | 1.0            | 3.09E-07          | 2.2E-08      | 1.00E-05           | 2E-03 | 8.82E-08            | 6.4E-09      | NA                             | --    |
| Zinc                            | 5.59E+02      | 1.0            | 3.09E-07          | 1.7E-04      | 3.00E-01           | 6E-04 | 8.82E-08            | 4.9E-05      | NA                             | --    |

\*The EPC values for chromium were assumed to be 10% hexavalent chromium and 90% trivalent chromium.  
 \*\*The EPC value for arsenic represents the time-weighted concentration, adjusted for the soil-specific RBA for waste rock (0.06) and overbank (0.60)

|                                 |                           |                                |                                   |
|---------------------------------|---------------------------|--------------------------------|-----------------------------------|
| Csoil = soil concentration      | HIF = human intake factor | NC = non-cancer                | RME = reasonable maximum exposure |
| CTE = central tendency exposure | HQ = hazard quotient      | RBA = relative bioavailability | SF = slope factor                 |
| d = day                         | kg = kilogram             | RfC = reference concentration  | NA = not available                |
| DI = dietary intake             | mg = milligram            | RfD = reference dose           | -- = not calculated               |

**TABLE D-6b**  
**RME RISK SUMMARY FOR THE HIKER**  
*Bonita Peak Mining District*

**Panel A: RME Non-Cancer Risks**

| Chemical of Potential Concern | Total HI <sup>1</sup> |              |              |              |
|-------------------------------|-----------------------|--------------|--------------|--------------|
|                               | EU1                   | EU2          | EU3          | EU4          |
| Antimony                      | 2E-03                 | 1E-02        | 1E-03        | 1E-03        |
| Arsenic                       | 4E-02                 | 2E-02        | 2E-02        | 1E-01        |
| Cadmium                       | 4E-03                 | 2E-03        | 1E-03        | 8E-04        |
| Chromium(III)                 | 5E-07                 | 6E-07        | 6E-07        | 5E-07        |
| Chromium(VI)                  | 3E-05                 | 3E-05        | 3E-05        | 3E-05        |
| Cobalt                        | 1E-02                 | 7E-03        | 5E-03        | 9E-03        |
| Iron                          | 9E-03                 | 1E-02        | 1E-02        | 1E-02        |
| Manganese                     | 8E-02                 | 8E-02        | 2E-02        | 2E-02        |
| Thallium                      | 1E-02                 | 7E-03        | 2E-02        | 2E-03        |
| Zinc                          | 1E-03                 | 1E-03        | 7E-04        | 6E-04        |
| <b>Total</b>                  | <b>2E-01</b>          | <b>1E-01</b> | <b>8E-02</b> | <b>1E-01</b> |

**Panel B: RME Cancer Risks**

| Chemical of Potential Concern | Total Risk <sup>1</sup> |              |              |              |
|-------------------------------|-------------------------|--------------|--------------|--------------|
|                               | EU1                     | EU2          | EU3          | EU4          |
| Antimony                      | --                      | --           | --           | --           |
| Arsenic                       | 6E-06                   | 3E-06        | 3E-06        | 1E-05        |
| Cadmium                       | --                      | --           | --           | --           |
| Chromium(III)                 | --                      | --           | --           | --           |
| Chromium(VI)                  | 3E-08                   | 3E-08        | 3E-08        | 2E-08        |
| Cobalt                        | --                      | --           | --           | --           |
| Iron                          | --                      | --           | --           | --           |
| Manganese                     | --                      | --           | --           | --           |
| Thallium                      | --                      | --           | --           | --           |
| Zinc                          | --                      | --           | --           | --           |
| <b>Total</b>                  | <b>6E-06</b>            | <b>3E-06</b> | <b>3E-06</b> | <b>1E-05</b> |

**Notes:**

[1] Based on incidental soil ingestion only.

-- = not calculated

HI = hazard index

RME = reasonable maximum exposure

**TABLE D-7a**  
**DETAILED RISK CALCULATIONS FOR THE CAMPER (USFS) IN EU6**  
*Bonita Peak Mining District*

**Panel A. CTE Scenario**  
**Incidental Ingestion of Surface Water**

| Chemical of Potential Concern | Cwater (mg/L) | RBA (unitless) | Non Cancer Hazard |          |             |         |         |                    |          | Cancer Risk        |          |             |         |         |                                 |          |    |
|-------------------------------|---------------|----------------|-------------------|----------|-------------|---------|---------|--------------------|----------|--------------------|----------|-------------|---------|---------|---------------------------------|----------|----|
|                               |               |                | HIFNC (L/kg d)    |          | DI (L/kg d) |         |         | Oral RfD (mg/kg d) | HQ       | HIFCancer (L/kg d) |          | DI (L/kg d) |         |         | Oral SF (mg/kg d) <sup>-1</sup> | Risk     |    |
|                               |               |                | Adult             | Child    | Adult       | Child   | Total   |                    |          | Adult              | Child    | Adult       | Child   | Total   |                                 |          |    |
| Aluminum                      | 8.80E-01      |                | 1.0               | 3.55E-07 | 3.13E-06    | 3.1E-07 | 2.8E-06 | 3.1E-06            | 1.00E+00 | 3E-06              | 6.08E-08 | 8.95E-08    | 5.4E-08 | 7.9E-08 | 1.3E-07                         | NA       | -- |
| Antimony                      | --            | [a]            | 1.0               | 3.55E-07 | 3.13E-06    | --      | --      | --                 | 4.00E-04 | --                 | 6.08E-08 | 8.95E-08    | --      | --      | --                              | NA       | -- |
| Arsenic                       | 1.30E-04      | [b]            | 1.0               | 3.55E-07 | 3.13E-06    | 4.6E-11 | 4.1E-10 | --                 | 3.00E-04 | --                 | 6.08E-08 | 8.95E-08    | 7.9E-12 | 1.2E-11 | --                              | 1.50E+00 | -- |
| Beryllium                     | --            | [a]            | 1.0               | 3.55E-07 | 3.13E-06    | --      | --      | --                 | 2.00E-03 | --                 | 6.08E-08 | 8.95E-08    | --      | --      | --                              | NA       | -- |
| Cadmium                       | 2.40E-04      | [b]            | 1.0               | 3.55E-07 | 3.13E-06    | 8.5E-11 | 7.5E-10 | --                 | 5.00E-04 | --                 | 6.08E-08 | 8.95E-08    | 1.5E-11 | 2.1E-11 | --                              | NA       | -- |
| Chromium(III)                 | --            |                | 1.0               | 3.55E-07 | 3.13E-06    | --      | --      | --                 | 1.50E+00 | --                 | 6.08E-08 | 8.95E-08    | --      | --      | --                              | NA       | -- |
| Chromium(VI)                  | --            |                | 1.0               | 3.55E-07 | 3.13E-06    | --      | --      | --                 | 3.00E-03 | --                 | 6.08E-08 | 8.95E-08    | --      | --      | --                              | 5.00E-01 | -- |
| Cobalt                        | 9.70E-01      |                | 1.0               | 3.55E-07 | 3.13E-06    | 3.4E-07 | 3.0E-06 | --                 | 3.00E-04 | --                 | 6.08E-08 | 8.95E-08    | 5.9E-08 | 8.7E-08 | --                              | NA       | -- |
| Copper                        | --            | [a]            | 1.0               | 3.55E-07 | 3.13E-06    | --      | --      | --                 | 4.00E-02 | --                 | 6.08E-08 | 8.95E-08    | --      | --      | --                              | NA       | -- |
| Iron                          | 1.76E-01      |                | 1.0               | 3.55E-07 | 3.13E-06    | 6.3E-08 | 5.5E-07 | 6.2E-07            | 7.00E-01 | 9E-07              | 6.08E-08 | 8.95E-08    | 1.1E-08 | 1.6E-08 | 2.7E-08                         | NA       | -- |
| Manganese                     | 1.38E-01      |                | 1.0               | 3.55E-07 | 3.13E-06    | 4.9E-08 | 4.3E-07 | 4.8E-07            | 2.40E-02 | 2E-05              | 6.08E-08 | 8.95E-08    | 8.4E-09 | 1.2E-08 | 2.1E-08                         | NA       | -- |
| Strontium                     | 1.94E-01      |                | 1.0               | 3.55E-07 | 3.13E-06    | 6.9E-08 | 6.1E-07 | 6.8E-07            | 6.00E-01 | 1E-06              | 6.08E-08 | 8.95E-08    | 1.2E-08 | 1.7E-08 | 2.9E-08                         | NA       | -- |
| Thallium                      | 8.53E-03      | [b]            | 1.0               | 3.55E-07 | 3.13E-06    | 3.0E-09 | 2.7E-08 | 3.0E-08            | 1.00E-05 | 3E-03              | 6.08E-08 | 8.95E-08    | 5.2E-10 | 7.6E-10 | 1.3E-09                         | NA       | -- |
| Zinc                          | 6.05E-02      |                | 1.0               | 3.55E-07 | 3.13E-06    | 2.1E-08 | 1.9E-07 | 2.1E-07            | 3.00E-01 | 7E-07              | 6.08E-08 | 8.95E-08    | 3.7E-09 | 5.4E-09 | 9.1E-09                         | NA       | -- |

**Ingestion of Groundwater (as drinking water)**

| Chemical of Potential Concern | Cwater (mg/L) | RBA (unitless) | Non Cancer Hazard |          |             |         |         |                    | Cancer Risk |                    |          |             |         |         |                                 |          |       |
|-------------------------------|---------------|----------------|-------------------|----------|-------------|---------|---------|--------------------|-------------|--------------------|----------|-------------|---------|---------|---------------------------------|----------|-------|
|                               |               |                | HIFNC (L/kg d)    |          | DI (L/kg d) |         |         | Oral RfD (mg/kg d) | HQ          | HIFCancer (L/kg d) |          | DI (L/kg d) |         |         | Oral SF (mg/kg d) <sup>-1</sup> | Risk     |       |
|                               |               |                | Adult             | Child    | Adult       | Child   | Total   |                    |             | Adult              | Child    | Adult       | Child   | Total   |                                 |          |       |
| Chromium(III)                 | 1.80E-03      |                | 1.0               | 4.73E-04 | 6.39E-04    | 8.5E-07 | 1.2E-06 | 2.0E-06            | 1.50E+00    | 1E-06              | 8.11E-05 | 1.83E-05    | 1.5E-07 | 3.3E-08 | 1.8E-07                         | NA       | --    |
| Chromium(VI)                  | 2.00E-04      |                | 1.0               | 4.73E-04 | 6.39E-04    | 9.5E-08 | 1.3E-07 | 2.2E-07            | 3.00E-03    | 7E-05              | 8.11E-05 | 1.83E-05    | 1.6E-08 | 3.7E-09 | 2.0E-08                         | 5.00E-01 | 3E-08 |

**Incidental Ingestion of Sediment**

| Chemical of Potential Concern | Csediment (mg/kg) | RBA (unitless) | Non Cancer Hazard |          |              |         |         |                    | Cancer Risk |                     |          |              |         |         |                                 |          |       |
|-------------------------------|-------------------|----------------|-------------------|----------|--------------|---------|---------|--------------------|-------------|---------------------|----------|--------------|---------|---------|---------------------------------|----------|-------|
|                               |                   |                | HIFNC (kg/kg d)   |          | DI (mg/kg d) |         |         | Oral RfD (mg/kg d) | HQ          | HIFCancer (kg/kg d) |          | DI (mg/kg d) |         |         | Oral SF (mg/kg d) <sup>-1</sup> | Risk     |       |
|                               |                   |                | Adult             | Child    | Adult        | Child   | Total   |                    |             | Adult               | Child    | Adult        | Child   | Total   |                                 |          |       |
| Arsenic                       | 2.81E+01          |                | 0.06              | 1.69E-08 | 6.39E-08     | 2.8E-08 | 1.1E-07 | 1.4E-07            | 3.00E-04    | 5E-04               | 2.90E-09 | 1.83E-09     | 4.9E-09 | 3.1E-09 | 8.0E-09                         | 1.50E+00 | 1E-08 |
| Cadmium                       | 3.62E+00          |                | 1.0               | 1.69E-08 | 6.39E-08     | 6.1E-08 | 2.3E-07 | 2.9E-07            | 1.00E-03    | 3E-04               | 2.90E-09 | 1.83E-09     | 1.0E-08 | 6.6E-09 | 1.7E-08                         | NA       | --    |
| Chromium(III)                 | 3.13E+00          |                | 1.0               | 1.69E-08 | 6.39E-08     | 5.3E-08 | 2.0E-07 | 2.5E-07            | 1.50E+00    | 2E-07               | 2.90E-09 | 1.83E-09     | 9.1E-09 | 5.7E-09 | 1.5E-08                         | NA       | --    |
| Chromium(VI)                  | 3.47E-01          |                | 1.0               | 1.69E-08 | 6.39E-08     | 5.9E-09 | 2.2E-08 | 2.8E-08            | 3.00E-03    | 9E-06               | 2.90E-09 | 1.83E-09     | 1.0E-09 | 6.3E-10 | 1.6E-09                         | 5.00E-01 | 4E-09 |
| Cobalt                        | 3.41E+01          | [c]            | 1.0               | 1.69E-08 | 6.39E-08     | 5.8E-07 | 2.2E-06 | 2.8E-06            | 3.00E-04    | 9E-03               | 2.90E-09 | 1.83E-09     | 9.9E-08 | 6.2E-08 | 1.6E-07                         | NA       | --    |
| Copper                        | 2.47E+01          | [c]            | 1.0               | 1.69E-08 | 6.39E-08     | 4.2E-07 | 1.6E-06 | 2.0E-06            | 4.00E-02    | 5E-05               | 2.90E-09 | 1.83E-09     | 7.1E-08 | 4.5E-08 | 1.2E-07                         | NA       | --    |
| Iron                          | 3.30E+04          |                | 1.0               | 1.69E-08 | 6.39E-08     | 5.6E-04 | 2.1E-03 | 2.7E-03            | 7.00E-01    | 4E-03               | 2.90E-09 | 1.83E-09     | 9.6E-05 | 6.0E-05 | 1.6E-04                         | NA       | --    |
| Manganese                     | 2.88E+03          | [c]            | 1.0               | 1.69E-08 | 6.39E-08     | 4.9E-05 | 1.8E-04 | 2.3E-04            | 2.40E-02    | 1E-02               | 2.90E-09 | 1.83E-09     | 8.3E-06 | 5.3E-06 | 1.4E-05                         | NA       | --    |
| Thallium                      | --                | [a]            | 1.0               | 1.69E-08 | 6.39E-08     | --      | --      | --                 | 1.00E-05    | --                  | 2.90E-09 | 1.83E-09     | --      | --      | --                              | NA       | --    |
| Zinc                          | 1.02E+03          |                | 1.0               | 1.69E-08 | 6.39E-08     | 1.7E-05 | 6.5E-05 | 8.2E-05            | 3.00E-01    | 3E-04               | 2.90E-09 | 1.83E-09     | 2.9E-06 | 1.9E-06 | 4.8E-06                         | NA       | --    |

**TABLE D-7a**  
**DETAILED RISK CALCULATIONS FOR THE CAMPER (USFS) IN EU6**  
*Bonita Peak Mining District*

**Incidental Ingestion of Soil**

| Chemical of Potential Concern | Csoil (mg/kg) |     | RBA (unitless) | Non Cancer Hazard |          |              |         |         |                    | Cancer Risk |                     |          |              |         |         |                                 |       |
|-------------------------------|---------------|-----|----------------|-------------------|----------|--------------|---------|---------|--------------------|-------------|---------------------|----------|--------------|---------|---------|---------------------------------|-------|
|                               |               |     |                | HIFNC (kg/kg d)   |          | DI (mg/kg d) |         |         | Oral RfD (mg/kg d) | HQ          | HIFCancer (kg/kg d) |          | DI (mg/kg d) |         |         | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
|                               |               |     |                | Adult             | Child    | Adult        | Child   | Total   |                    |             | Adult               | Child    | Adult        | Child   | Total   |                                 |       |
| Antimony                      | 8.00E-01      | [e] | 1.0            | 3.38E-08          | 2.60E-07 | 2.7E-08      | 2.1E-07 | 2.3E-07 | 4.00E-04           | 6E-04       | 5.79E-09            | 7.42E-09 | 4.6E-09      | 5.9E-09 | 1.1E-08 | NA                              | --    |
| Arsenic                       | 1.87E+01      | [e] | 0.07           | 3.38E-08          | 2.60E-07 | 4.4E-08      | 3.4E-07 | 3.8E-07 | 3.00E-04           | 1E-03       | 5.79E-09            | 7.42E-09 | 7.6E-09      | 9.7E-09 | 1.7E-08 | 1.50E+00                        | 3E-08 |
| Cadmium                       | 1.10E+00      | [e] | 1.0            | 3.38E-08          | 2.60E-07 | 3.7E-08      | 2.9E-07 | 3.2E-07 | 1.00E-03           | 3E-04       | 5.79E-09            | 7.42E-09 | 6.4E-09      | 8.2E-09 | 1.5E-08 | NA                              | --    |
| Chromium(III)                 | 4.32E+00      |     | 1.0            | 3.38E-08          | 2.60E-07 | 1.5E-07      | 1.1E-06 | 1.3E-06 | 1.50E+00           | 8E-07       | 5.79E-09            | 7.42E-09 | 2.5E-08      | 3.2E-08 | 5.7E-08 | NA                              | --    |
| Chromium(VI)                  | 4.80E-01      |     | 1.0            | 3.38E-08          | 2.60E-07 | 1.6E-08      | 1.2E-07 | 1.4E-07 | 3.00E-03           | 5E-05       | 5.79E-09            | 7.42E-09 | 2.8E-09      | 3.6E-09 | 6.3E-09 | 5.00E-01                        | 2E-08 |
| Cobalt                        | 9.40E+00      | [e] | 1.0            | 3.38E-08          | 2.60E-07 | 3.2E-07      | 2.4E-06 | 2.8E-06 | 3.00E-04           | 9E-03       | 5.79E-09            | 7.42E-09 | 5.4E-08      | 7.0E-08 | 1.2E-07 | NA                              | --    |
| Iron                          | 2.21E+04      | [e] | 1.0            | 3.38E-08          | 2.60E-07 | 7.5E-04      | 5.7E-03 | 6.5E-03 | 7.00E-01           | 9E-03       | 5.79E-09            | 7.42E-09 | 1.3E-04      | 1.6E-04 | 2.9E-04 | NA                              | --    |
| Manganese                     | 1.40E+03      | [e] | 1.0            | 3.38E-08          | 2.60E-07 | 4.7E-05      | 3.6E-04 | 4.1E-04 | 2.40E-02           | 2E-02       | 5.79E-09            | 7.42E-09 | 8.1E-06      | 1.0E-05 | 1.8E-05 | NA                              | --    |
| Thallium                      | 9.90E-02      | [e] | 1.0            | 3.38E-08          | 2.60E-07 | 3.3E-09      | 2.6E-08 | 2.9E-08 | 1.00E-05           | 3E-03       | 5.79E-09            | 7.42E-09 | 5.7E-10      | 7.3E-10 | 1.3E-09 | NA                              | --    |
| Zinc                          | 2.70E+02      | [e] | 1.0            | 3.38E-08          | 2.60E-07 | 9.1E-06      | 7.0E-05 | 7.9E-05 | 3.00E-01           | 3E-04       | 5.79E-09            | 7.42E-09 | 1.6E-06      | 2.0E-06 | 3.6E-06 | NA                              | --    |

**Panel B. RME Scenario**

**Incidental Ingestion of Surface Water**

| Chemical of Potential Concern | Cwater (mg/L) |     | RBA (unitless) | Non Cancer Hazard |          |             |         |         |                    | Cancer Risk |                    |          |             |         |         |                                 |      |
|-------------------------------|---------------|-----|----------------|-------------------|----------|-------------|---------|---------|--------------------|-------------|--------------------|----------|-------------|---------|---------|---------------------------------|------|
|                               |               |     |                | HIFNC (L/kg d)    |          | DI (L/kg d) |         |         | Oral RfD (mg/kg d) | HQ          | HIFCancer (L/kg d) |          | DI (L/kg d) |         |         | Oral SF (mg/kg d) <sup>-1</sup> | Risk |
|                               |               |     |                | Adult             | Child    | Adult       | Child   | Total   |                    |             | Adult              | Child    | Adult       | Child   | Total   |                                 |      |
| Aluminum                      | 8.80E-01      |     | 1.0            | 7.20E-06          | 3.13E-06 | 6.3E-06     | 2.8E-06 | 9.1E-06 | 1.00E+00           | 9E-06       | 2.06E-06           | 8.95E-08 | 1.8E-06     | 7.9E-08 | 1.9E-06 | NA                              | --   |
| Antimony                      | --            | [a] | 1.0            | 7.20E-06          | 3.13E-06 | --          | --      | --      | 4.00E-04           | --          | 2.06E-06           | 8.95E-08 | --          | --      | --      | NA                              | --   |
| Arsenic                       | 1.30E-04      | [b] | 1.0            | 7.20E-06          | 3.13E-06 | 9.4E-10     | 4.1E-10 | --      | 3.00E-04           | --          | 2.06E-06           | 8.95E-08 | 2.7E-10     | 1.2E-11 | --      | 1.50E+00                        | --   |
| Beryllium                     | --            | [a] | 1.0            | 7.20E-06          | 3.13E-06 | --          | --      | --      | 2.00E-03           | --          | 2.06E-06           | 8.95E-08 | --          | --      | --      | NA                              | --   |
| Cadmium                       | 2.40E-04      | [b] | 1.0            | 7.20E-06          | 3.13E-06 | 1.7E-09     | 7.5E-10 | --      | 5.00E-04           | --          | 2.06E-06           | 8.95E-08 | 4.9E-10     | 2.1E-11 | --      | NA                              | --   |
| Chromium(III)                 | --            |     | 1.0            | 7.20E-06          | 3.13E-06 | --          | --      | --      | 1.50E+00           | --          | 2.06E-06           | 8.95E-08 | --          | --      | --      | NA                              | --   |
| Chromium(VI)                  | --            |     | 1.0            | 7.20E-06          | 3.13E-06 | --          | --      | --      | 3.00E-03           | --          | 2.06E-06           | 8.95E-08 | --          | --      | --      | 5.00E-01                        | --   |
| Cobalt                        | 9.70E-01      |     | 1.0            | 7.20E-06          | 3.13E-06 | 7.0E-06     | 3.0E-06 | --      | 3.00E-04           | --          | 2.06E-06           | 8.95E-08 | 2.0E-06     | 8.7E-08 | --      | NA                              | --   |
| Copper                        | --            | [a] | 1.0            | 7.20E-06          | 3.13E-06 | --          | --      | --      | 4.00E-02           | --          | 2.06E-06           | 8.95E-08 | --          | --      | --      | NA                              | --   |
| Iron                          | 1.76E-01      |     | 1.0            | 7.20E-06          | 3.13E-06 | 1.3E-06     | 5.5E-07 | 1.8E-06 | 7.00E-01           | 3E-06       | 2.06E-06           | 8.95E-08 | 3.6E-07     | 1.6E-08 | 3.8E-07 | NA                              | --   |
| Manganese                     | 1.38E-01      |     | 1.0            | 7.20E-06          | 3.13E-06 | 9.9E-07     | 4.3E-07 | 1.4E-06 | 2.40E-02           | 6E-05       | 2.06E-06           | 8.95E-08 | 2.8E-07     | 1.2E-08 | 2.9E-07 | NA                              | --   |
| Strontium                     | 1.94E-01      |     | 1.0            | 7.20E-06          | 3.13E-06 | 1.4E-06     | 6.1E-07 | 2.0E-06 | 6.00E-01           | 3E-06       | 2.06E-06           | 8.95E-08 | 4.0E-07     | 1.7E-08 | 4.2E-07 | NA                              | --   |
| Thallium                      | 8.53E-03      | [b] | 1.0            | 7.20E-06          | 3.13E-06 | 6.1E-08     | 2.7E-08 | 8.8E-08 | 1.00E-05           | 9E-03       | 2.06E-06           | 8.95E-08 | 1.8E-08     | 7.6E-10 | 1.8E-08 | NA                              | --   |
| Zinc                          | 6.05E-02      |     | 1.0            | 7.20E-06          | 3.13E-06 | 4.4E-07     | 1.9E-07 | 6.3E-07 | 3.00E-01           | 2E-06       | 2.06E-06           | 8.95E-08 | 1.2E-07     | 5.4E-09 | 1.3E-07 | NA                              | --   |

**Ingestion of Groundwater (as drinking water)**

| Chemical of Potential Concern | Cwater (mg/L) |  | RBA (unitless) | Non Cancer Hazard |          |             |         |         |                    | Cancer Risk |                    |          |             |         |         |                                 |       |
|-------------------------------|---------------|--|----------------|-------------------|----------|-------------|---------|---------|--------------------|-------------|--------------------|----------|-------------|---------|---------|---------------------------------|-------|
|                               |               |  |                | HIFNC (L/kg d)    |          | DI (L/kg d) |         |         | Oral RfD (mg/kg d) | HQ          | HIFCancer (L/kg d) |          | DI (L/kg d) |         |         | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
|                               |               |  |                | Adult             | Child    | Adult       | Child   | Total   |                    |             | Adult              | Child    | Adult       | Child   | Total   |                                 |       |
| Chromium(III)                 | 1.80E-03      |  | 1.0            | 1.69E-03          | 6.39E-04 | 3.0E-06     | 1.2E-06 | 4.2E-06 | 1.50E+00           | 3E-06       | 4.83E-04           | 1.83E-05 | 8.7E-07     | 3.3E-08 | 9.0E-07 | NA                              | --    |
| Chromium(VI)                  | 2.00E-04      |  | 1.0            | 1.69E-03          | 6.39E-04 | 3.4E-07     | 1.3E-07 | 4.7E-07 | 3.00E-03           | 2E-04       | 4.83E-04           | 1.83E-05 | 9.7E-08     | 3.7E-09 | 1.0E-07 | 5.00E-01                        | 1E-07 |

**TABLE D-7a**  
**DETAILED RISK CALCULATIONS FOR THE CAMPER (USFS) IN EU6**  
*Bonita Peak Mining District*

**Incidental Ingestion of Sediment**

| Chemical of Potential Concern | Csediment (mg/kg) | RBA (unitless) | Non Cancer Hazard |          |              |         |         |                    |          | Cancer Risk         |          |              |         |         |                                 |          |       |
|-------------------------------|-------------------|----------------|-------------------|----------|--------------|---------|---------|--------------------|----------|---------------------|----------|--------------|---------|---------|---------------------------------|----------|-------|
|                               |                   |                | HIFNC (kg/kg d)   |          | DI (mg/kg d) |         |         | Oral RfD (mg/kg d) | HQ       | HIFCancer (kg/kg d) |          | DI (mg/kg d) |         |         | Oral SF (mg/kg d) <sup>-1</sup> | Risk     |       |
|                               |                   |                | Adult             | Child    | Adult        | Child   | Total   |                    |          | Adult               | Child    | Adult        | Child   | Total   |                                 |          |       |
| Arsenic                       | 2.81E+01          |                | 0.06              | 6.76E-08 | 6.39E-08     | 1.1E-07 | 1.1E-07 | 2.2E-07            | 3.00E-04 | 7E-04               | 1.93E-08 | 1.83E-09     | 3.3E-08 | 3.1E-09 | 3.6E-08                         | 1.50E+00 | 5E-08 |
| Cadmium                       | 3.62E+00          |                | 1.0               | 6.76E-08 | 6.39E-08     | 2.4E-07 | 2.3E-07 | 4.8E-07            | 1.00E-03 | 5E-04               | 1.93E-08 | 1.83E-09     | 7.0E-08 | 6.6E-09 | 7.6E-08                         | NA       | --    |
| Chromium(III)                 | 3.13E+00          |                | 1.0               | 6.76E-08 | 6.39E-08     | 2.1E-07 | 2.0E-07 | 4.1E-07            | 1.50E+00 | 3E-07               | 1.93E-08 | 1.83E-09     | 6.0E-08 | 5.7E-09 | 6.6E-08                         | NA       | --    |
| Chromium(VI)                  | 3.47E-01          |                | 1.0               | 6.76E-08 | 6.39E-08     | 2.3E-08 | 2.2E-08 | 4.6E-08            | 3.00E-03 | 2E-05               | 1.93E-08 | 1.83E-09     | 6.7E-09 | 6.3E-10 | 7.3E-09                         | 5.00E-01 | 8E-09 |
| Cobalt                        | 3.41E+01          | [c]            | 1.0               | 6.76E-08 | 6.39E-08     | 2.3E-06 | 2.2E-06 | 4.5E-06            | 3.00E-04 | 1E-02               | 1.93E-08 | 1.83E-09     | 6.6E-07 | 6.2E-08 | 7.2E-07                         | NA       | --    |
| Copper                        | 2.47E+01          | [c]            | 1.0               | 6.76E-08 | 6.39E-08     | 1.7E-06 | 1.6E-06 | 3.2E-06            | 4.00E-02 | 8E-05               | 1.93E-08 | 1.83E-09     | 4.8E-07 | 4.5E-08 | 5.2E-07                         | NA       | --    |
| Iron                          | 3.30E+04          |                | 1.0               | 6.76E-08 | 6.39E-08     | 2.2E-03 | 2.1E-03 | 4.3E-03            | 7.00E-01 | 6E-03               | 1.93E-08 | 1.83E-09     | 6.4E-04 | 6.0E-05 | 7.0E-04                         | NA       | --    |
| Manganese                     | 2.88E+03          | [c]            | 1.0               | 6.76E-08 | 6.39E-08     | 1.9E-04 | 1.8E-04 | 3.8E-04            | 2.40E-02 | 2E-02               | 1.93E-08 | 1.83E-09     | 5.6E-05 | 5.3E-06 | 6.1E-05                         | NA       | --    |
| Thallium                      | --                | [a]            | 1.0               | 6.76E-08 | 6.39E-08     | --      | --      | --                 | 1.00E-05 | --                  | 1.93E-08 | 1.83E-09     | --      | --      | --                              | NA       | --    |
| Zinc                          | 1.02E+03          |                | 1.0               | 6.76E-08 | 6.39E-08     | 6.9E-05 | 6.5E-05 | 1.3E-04            | 3.00E-01 | 4E-04               | 1.93E-08 | 1.83E-09     | 2.0E-05 | 1.9E-06 | 2.1E-05                         | NA       | --    |

**Incidental Ingestion of Soil**

| Chemical of Potential Concern | Csoil (mg/kg) | RBA (unitless) | Non Cancer Hazard |          |              |         |         |                    |          | Cancer Risk         |          |              |         |         |                                 |          |       |
|-------------------------------|---------------|----------------|-------------------|----------|--------------|---------|---------|--------------------|----------|---------------------|----------|--------------|---------|---------|---------------------------------|----------|-------|
|                               |               |                | HIFNC (kg/kg d)   |          | DI (mg/kg d) |         |         | Oral RfD (mg/kg d) | HQ       | HIFCancer (kg/kg d) |          | DI (mg/kg d) |         |         | Oral SF (mg/kg d) <sup>-1</sup> | Risk     |       |
|                               |               |                | Adult             | Child    | Adult        | Child   | Total   |                    |          | Adult               | Child    | Adult        | Child   | Total   |                                 |          |       |
| Antimony                      | 8.00E-01      | [e]            | 1.0               | 1.35E-07 | 2.60E-07     | 1.1E-07 | 2.1E-07 | 3.2E-07            | 4.00E-04 | 8E-04               | 3.86E-08 | 7.42E-09     | 3.1E-08 | 5.9E-09 | 3.7E-08                         | NA       | --    |
| Arsenic                       | 1.87E+01      | [e]            | 0.07              | 1.35E-07 | 2.60E-07     | 1.8E-07 | 3.4E-07 | 5.2E-07            | 3.00E-04 | 2E-03               | 3.86E-08 | 7.42E-09     | 5.1E-08 | 9.7E-09 | 6.0E-08                         | 1.50E+00 | 9E-08 |
| Cadmium                       | 1.10E+00      | [e]            | 1.0               | 1.35E-07 | 2.60E-07     | 1.5E-07 | 2.9E-07 | 4.3E-07            | 1.00E-03 | 4E-04               | 3.86E-08 | 7.42E-09     | 4.2E-08 | 8.2E-09 | 5.1E-08                         | NA       | --    |
| Chromium(III)                 | 4.32E+00      |                | 1.0               | 1.35E-07 | 2.60E-07     | 5.8E-07 | 1.1E-06 | 1.7E-06            | 1.50E+00 | 1E-06               | 3.86E-08 | 7.42E-09     | 1.7E-07 | 3.2E-08 | 2.0E-07                         | NA       | --    |
| Chromium(VI)                  | 4.80E-01      |                | 1.0               | 1.35E-07 | 2.60E-07     | 6.5E-08 | 1.2E-07 | 1.9E-07            | 3.00E-03 | 6E-05               | 3.86E-08 | 7.42E-09     | 1.9E-08 | 3.6E-09 | 2.2E-08                         | 5.00E-01 | 3E-08 |
| Cobalt                        | 9.40E+00      | [e]            | 1.0               | 1.35E-07 | 2.60E-07     | 1.3E-06 | 2.4E-06 | 3.7E-06            | 3.00E-04 | 1E-02               | 3.86E-08 | 7.42E-09     | 3.6E-07 | 7.0E-08 | 4.3E-07                         | NA       | --    |
| Iron                          | 2.21E+04      | [e]            | 1.0               | 1.35E-07 | 2.60E-07     | 3.0E-03 | 5.7E-03 | 8.7E-03            | 7.00E-01 | 1E-02               | 3.86E-08 | 7.42E-09     | 8.5E-04 | 1.6E-04 | 1.0E-03                         | NA       | --    |
| Manganese                     | 1.40E+03      | [e]            | 1.0               | 1.35E-07 | 2.60E-07     | 1.9E-04 | 3.6E-04 | 5.5E-04            | 2.40E-02 | 2E-02               | 3.86E-08 | 7.42E-09     | 5.4E-05 | 1.0E-05 | 6.4E-05                         | NA       | --    |
| Thallium                      | 9.90E-02      | [e]            | 1.0               | 1.35E-07 | 2.60E-07     | 1.3E-08 | 2.6E-08 | 3.9E-08            | 1.00E-05 | 4E-03               | 3.86E-08 | 7.42E-09     | 3.8E-09 | 7.3E-10 | 4.6E-09                         | NA       | --    |
| Zinc                          | 2.70E+02      | [e]            | 1.0               | 1.35E-07 | 2.60E-07     | 3.6E-05 | 7.0E-05 | 1.1E-04            | 3.00E-01 | 4E-04               | 3.86E-08 | 7.42E-09     | 1.0E-05 | 2.0E-06 | 1.2E-05                         | NA       | --    |

\*The EPC values for chromium were assumed to be 10% hexavalent chromium and 90% trivalent chromium.

Csediment = sediment concentration      L = liter  
Csoil = soil concentration                      mg = milligram  
Cwater = water concentration                NC = non-cancer  
CTE = central tendency exposure            RBA = relative bioavailability  
d = day                                                RfD = reference dose  
DI = dietary intake                                RME = reasonable maximum exposure  
HIF = human intake factor                    SF = slope factor  
HQ = hazard quotient                            TWF = time-weighting factor  
kg = kilogram

NA = not available  
-- = not calculated

## RME RISK SUMMARY FOR THE ADULT CAMPER (USFS)

Bonita Peak Mining District

### Panel A: RME Non-Cancer Risks

| Chemical of Potential Concern | Incidental SW Ingestion | Ingestion of GW (as drinking water) | Incidental Sed Ingestion | Incidental Soil Ingestion | Total HI     |
|-------------------------------|-------------------------|-------------------------------------|--------------------------|---------------------------|--------------|
| Aluminum                      | 9E-06                   | --                                  | --                       | --                        | 9E-06        |
| Antimony                      | --                      | --                                  | --                       | 8E-04                     | 8E-04        |
| Arsenic                       | --                      | --                                  | 7E-04                    | 2E-03                     | 2E-03        |
| Beryllium                     | --                      | --                                  | --                       | --                        | --           |
| Cadmium                       | --                      | --                                  | 5E-04                    | 4E-04                     | 9E-04        |
| Chromium(III)                 | --                      | 3E-06                               | 3E-07                    | 1E-06                     | 4E-06        |
| Chromium(VI)                  | --                      | 2E-04                               | 2E-05                    | 6E-05                     | 2E-04        |
| Cobalt                        | --                      | --                                  | 1E-02                    | 1E-02                     | 3E-02        |
| Copper                        | --                      | --                                  | 8E-05                    | --                        | --           |
| Iron                          | 3E-06                   | --                                  | 6E-03                    | 1E-02                     | 2E-02        |
| Manganese                     | 6E-05                   | --                                  | 2E-02                    | 2E-02                     | 4E-02        |
| Strontium                     | 3E-06                   | --                                  | --                       | --                        | 3E-06        |
| Thallium                      | 9E-03                   | --                                  | --                       | 4E-03                     | 1E-02        |
| Zinc                          | 2E-06                   | --                                  | 4E-04                    | 4E-04                     | 8E-04        |
| <b>Total</b>                  | <b>9E-03</b>            | <b>2E-04</b>                        | <b>4E-02</b>             | <b>6E-02</b>              | <b>1E-01</b> |

### Panel B: RME Cancer Risks

| Chemical of Potential Concern | Incidental SW Ingestion | Ingestion of GW (as drinking water) | Incidental Sed Ingestion | Incidental Soil Ingestion | Total Risk   |
|-------------------------------|-------------------------|-------------------------------------|--------------------------|---------------------------|--------------|
| Aluminum                      | --                      | --                                  | --                       | --                        | --           |
| Antimony                      | --                      | --                                  | --                       | --                        | --           |
| Arsenic                       | --                      | --                                  | 5E-08                    | 9E-08                     | 1E-07        |
| Beryllium                     | --                      | --                                  | --                       | --                        | --           |
| Cadmium                       | --                      | --                                  | --                       | --                        | --           |
| Chromium(III)                 | --                      | --                                  | --                       | --                        | --           |
| Chromium(VI)                  | --                      | 1E-07                               | 8E-09                    | 3E-08                     | 1E-07        |
| Cobalt                        | --                      | --                                  | --                       | --                        | --           |
| Copper                        | --                      | --                                  | --                       | --                        | --           |
| Iron                          | --                      | --                                  | --                       | --                        | --           |
| Manganese                     | --                      | --                                  | --                       | --                        | --           |
| Strontium                     | --                      | --                                  | --                       | --                        | --           |
| Thallium                      | --                      | --                                  | --                       | --                        | --           |
| Zinc                          | --                      | --                                  | --                       | --                        | --           |
| <b>Total</b>                  | <b>--</b>               | <b>1E-07</b>                        | <b>6E-08</b>             | <b>1E-07</b>              | <b>3E-07</b> |

#### Notes:

-- = not calculated

GW = groundwater

HI = hazard index

RME = reasonable maximum exposure

**TABLE D-8a**  
**DETAILED RISK CALCULATIONS FOR THE CAMPER (DISPERSED) IN EU7**  
 Bonita Peak Mining District

**Panel A. CTE Scenario**  
**Incidental Ingestion of Surface Water**

| Chemical of Potential Concern | Cwater (mg/L) | RBA (unitless) | Non Cancer Hazard |          |             |         |         |                    |       | Cancer Risk        |          |             |         |         | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
|-------------------------------|---------------|----------------|-------------------|----------|-------------|---------|---------|--------------------|-------|--------------------|----------|-------------|---------|---------|---------------------------------|-------|
|                               |               |                | HIFNC (L/kg d)    |          | DI (L/kg d) |         |         | Oral RfD (mg/kg d) | HQ    | HIFCancer (L/kg d) |          | DI (L/kg d) |         |         |                                 |       |
|                               |               |                | Adult             | Child    | Adult       | Child   | Total   |                    |       | Adult              | Child    | Adult       | Child   | Total   |                                 |       |
| Aluminum                      | 1.16E+00      | 1.0            | 7.09E-07          | 3.13E-06 | 8.2E-07     | 3.6E-06 | 4.4E-06 | 1.00E+00           | 4E-06 | 1.22E-07           | 8.95E-08 | 1.4E-07     | 1.0E-07 | 2.4E-07 | NA                              | --    |
| Antimony                      | 5.04E-03 [b]  | 1.0            | 7.09E-07          | 3.13E-06 | 3.6E-09     | 1.6E-08 | 1.9E-08 | 4.00E-04           | 5E-05 | 1.22E-07           | 8.95E-08 | 6.1E-10     | 4.5E-10 | 1.1E-09 | NA                              | --    |
| Arsenic                       | 7.67E-04      | 1.0            | 7.09E-07          | 3.13E-06 | 5.4E-10     | 2.4E-09 | 2.9E-09 | 3.00E-04           | 1E-05 | 1.22E-07           | 8.95E-08 | 9.3E-11     | 6.9E-11 | 1.6E-10 | 1.50E+00                        | 2E-10 |
| Beryllium                     | 4.63E-03 [b]  | 1.0            | 7.09E-07          | 3.13E-06 | 3.3E-09     | 1.5E-08 | 1.8E-08 | 2.00E-03           | 9E-06 | 1.22E-07           | 8.95E-08 | 5.6E-10     | 4.1E-10 | 9.8E-10 | NA                              | --    |
| Cadmium                       | 4.83E-03      | 1.0            | 7.09E-07          | 3.13E-06 | 3.4E-09     | 1.5E-08 | 1.9E-08 | 5.00E-04           | 4E-05 | 1.22E-07           | 8.95E-08 | 5.9E-10     | 4.3E-10 | 1.0E-09 | NA                              | --    |
| Chromium(III)                 | 7.88E-03      | 1.0            | 7.09E-07          | 3.13E-06 | 5.6E-09     | 2.5E-08 | 3.0E-08 | 1.50E+00           | 2E-08 | 1.22E-07           | 8.95E-08 | 9.6E-10     | 7.1E-10 | 1.7E-09 | NA                              | --    |
| Chromium(VI)                  | 8.76E-04      | 1.0            | 7.09E-07          | 3.13E-06 | 6.2E-10     | 2.7E-09 | 3.4E-09 | 3.00E-03           | 1E-06 | 1.22E-07           | 8.95E-08 | 1.1E-10     | 7.8E-11 | 1.8E-10 | 5.00E-01                        | 5E-10 |
| Cobalt                        | 3.06E-03      | 1.0            | 7.09E-07          | 3.13E-06 | 2.2E-09     | 9.6E-09 | 1.2E-08 | 3.00E-04           | 4E-05 | 1.22E-07           | 8.95E-08 | 3.7E-10     | 2.7E-10 | 6.5E-10 | NA                              | --    |
| Copper                        | 3.01E-02      | 1.0            | 7.09E-07          | 3.13E-06 | 2.1E-08     | 9.4E-08 | 1.2E-07 | 4.00E-02           | 3E-06 | 1.22E-07           | 8.95E-08 | 3.7E-09     | 2.7E-09 | 6.4E-09 | NA                              | --    |
| Iron                          | 3.09E+00      | 1.0            | 7.09E-07          | 3.13E-06 | 2.2E-06     | 9.7E-06 | 1.2E-05 | 7.00E-01           | 2E-05 | 1.22E-07           | 8.95E-08 | 3.8E-07     | 2.8E-07 | 6.5E-07 | NA                              | --    |
| Manganese                     | 8.43E-01      | 1.0            | 7.09E-07          | 3.13E-06 | 6.0E-07     | 2.6E-06 | 3.2E-06 | 2.40E-02           | 1E-04 | 1.22E-07           | 8.95E-08 | 1.0E-07     | 7.5E-08 | 1.8E-07 | NA                              | --    |
| Strontium                     | 4.92E-01      | 1.0            | 7.09E-07          | 3.13E-06 | 3.5E-07     | 1.5E-06 | 1.9E-06 | 6.00E-01           | 3E-06 | 1.22E-07           | 8.95E-08 | 6.0E-08     | 4.4E-08 | 1.0E-07 | NA                              | --    |
| Thallium                      | 1.36E-03      | 1.0            | 7.09E-07          | 3.13E-06 | 9.7E-10     | 4.3E-09 | 5.2E-09 | 1.00E-05           | 5E-04 | 1.22E-07           | 8.95E-08 | 1.7E-10     | 1.2E-10 | 2.9E-10 | NA                              | --    |
| Zinc                          | 1.18E+00      | 1.0            | 7.09E-07          | 3.13E-06 | 8.4E-07     | 3.7E-06 | 4.5E-06 | 3.00E-01           | 2E-05 | 1.22E-07           | 8.95E-08 | 1.4E-07     | 1.1E-07 | 2.5E-07 | NA                              | --    |

**Ingestion of Surface Water (as drinking water)**

| Chemical of Potential Concern | Cwater (mg/L) | RBA (unitless) | Non Cancer Hazard |          |             |         |         | Cancer Risk        |       |                    |          |             | Oral SF (mg/kg d) <sup>-1</sup> | Risk    |          |       |
|-------------------------------|---------------|----------------|-------------------|----------|-------------|---------|---------|--------------------|-------|--------------------|----------|-------------|---------------------------------|---------|----------|-------|
|                               |               |                | HIFNC (L/kg d)    |          | DI (L/kg d) |         |         | Oral RfD (mg/kg d) | HQ    | HIFCancer (L/kg d) |          | DI (L/kg d) |                                 |         |          |       |
|                               |               |                | Adult             | Child    | Adult       | Child   | Total   |                    |       | Adult              | Child    | Adult       |                                 |         | Child    | Total |
| Aluminum                      | 1.16E+00      | 1.0            | 9.46E-04          | 6.39E-04 | 1.1E-03     | 7.4E-04 | 1.8E-03 | 1.00E+00           | 2E-03 | 1.62E-04           | 1.83E-05 | 1.9E-04     | 2.1E-05                         | 2.1E-04 | NA       | --    |
| Antimony                      | 5.04E-03 [b]  | 1.0            | 9.46E-04          | 6.39E-04 | 4.8E-06     | 3.2E-06 | 8.0E-06 | 4.00E-04           | 2E-02 | 1.62E-04           | 1.83E-05 | 8.2E-07     | 9.2E-08                         | 9.1E-07 | NA       | --    |
| Arsenic                       | 7.67E-04      | 1.0            | 9.46E-04          | 6.39E-04 | 7.3E-07     | 4.9E-07 | 1.2E-06 | 3.00E-04           | 4E-03 | 1.62E-04           | 1.83E-05 | 1.2E-07     | 1.4E-08                         | 1.4E-07 | 1.50E+00 | 2E-07 |
| Beryllium                     | 4.63E-03 [b]  | 1.0            | 9.46E-04          | 6.39E-04 | 4.4E-06     | 3.0E-06 | 7.3E-06 | 2.00E-03           | 4E-03 | 1.62E-04           | 1.83E-05 | 7.5E-07     | 8.5E-08                         | 8.4E-07 | NA       | --    |
| Cadmium                       | 4.83E-03      | 1.0            | 9.46E-04          | 6.39E-04 | 4.6E-06     | 3.1E-06 | 7.7E-06 | 5.00E-04           | 2E-02 | 1.62E-04           | 1.83E-05 | 7.8E-07     | 8.8E-08                         | 8.7E-07 | NA       | --    |
| Chromium(III)                 | 7.88E-03      | 1.0            | 9.46E-04          | 6.39E-04 | 7.5E-06     | 5.0E-06 | 1.2E-05 | 1.50E+00           | 8E-06 | 1.62E-04           | 1.83E-05 | 1.3E-06     | 1.4E-07                         | 1.4E-06 | NA       | --    |
| Chromium(VI)                  | 8.76E-04      | 1.0            | 9.46E-04          | 6.39E-04 | 8.3E-07     | 5.6E-07 | 1.4E-06 | 3.00E-03           | 5E-04 | 1.62E-04           | 1.83E-05 | 1.4E-07     | 1.6E-08                         | 1.6E-07 | 5.00E-01 | 2E-07 |
| Cobalt                        | 3.06E-03      | 1.0            | 9.46E-04          | 6.39E-04 | 2.9E-06     | 2.0E-06 | 4.9E-06 | 3.00E-04           | 2E-02 | 1.62E-04           | 1.83E-05 | 5.0E-07     | 5.6E-08                         | 5.5E-07 | NA       | --    |
| Copper                        | 3.01E-02      | 1.0            | 9.46E-04          | 6.39E-04 | 2.8E-05     | 1.9E-05 | 4.8E-05 | 4.00E-02           | 1E-03 | 1.62E-04           | 1.83E-05 | 4.9E-06     | 5.5E-07                         | 5.4E-06 | NA       | --    |
| Iron                          | 3.09E+00      | 1.0            | 9.46E-04          | 6.39E-04 | 2.9E-03     | 2.0E-03 | 4.9E-03 | 7.00E-01           | 7E-03 | 1.62E-04           | 1.83E-05 | 5.0E-04     | 5.6E-05                         | 5.6E-04 | NA       | --    |
| Manganese                     | 8.43E-01      | 1.0            | 9.46E-04          | 6.39E-04 | 8.0E-04     | 5.4E-04 | 1.3E-03 | 2.40E-02           | 6E-02 | 1.62E-04           | 1.83E-05 | 1.4E-04     | 1.5E-05                         | 1.5E-04 | NA       | --    |
| Strontium                     | 4.92E-01      | 1.0            | 9.46E-04          | 6.39E-04 | 4.7E-04     | 3.1E-04 | 7.8E-04 | 6.00E-01           | 1E-03 | 1.62E-04           | 1.83E-05 | 8.0E-05     | 9.0E-06                         | 8.9E-05 | NA       | --    |
| Thallium                      | 1.36E-03      | 1.0            | 9.46E-04          | 6.39E-04 | 1.3E-06     | 8.7E-07 | 2.2E-06 | 1.00E-05           | 2E-01 | 1.62E-04           | 1.83E-05 | 2.2E-07     | 2.5E-08                         | 2.5E-07 | NA       | --    |
| Zinc                          | 1.18E+00      | 1.0            | 9.46E-04          | 6.39E-04 | 1.1E-03     | 7.6E-04 | 1.9E-03 | 3.00E-01           | 6E-03 | 1.62E-04           | 1.83E-05 | 1.9E-04     | 2.2E-05                         | 2.1E-04 | NA       | --    |

**TABLE D-8a**  
**DETAILED RISK CALCULATIONS FOR THE CAMPER (DISPERSED) IN EU7**  
 Bonita Peak Mining District

**Incidental Ingestion of Sediment**

| Chemical of Potential Concern | Csediment (mg/kg) | RBA (unitless) | Non Cancer Hazard |          |              |         |         |                    |       | Cancer Risk         |          |              |         |         |                                 |       |
|-------------------------------|-------------------|----------------|-------------------|----------|--------------|---------|---------|--------------------|-------|---------------------|----------|--------------|---------|---------|---------------------------------|-------|
|                               |                   |                | HIFNC (kg/kg d)   |          | DI (mg/kg d) |         |         | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) |          | DI (mg/kg d) |         |         | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
|                               |                   |                | Adult             | Child    | Adult        | Child   | Total   |                    |       | Adult               | Child    | Adult        | Child   | Total   |                                 |       |
| Arsenic                       | 3.23E+01          | 0.06           | 3.38E-08          | 6.39E-08 | 6.6E-08      | 1.2E-07 | 1.9E-07 | 3.00E-04           | 6E-04 | 5.79E-09            | 1.83E-09 | 1.1E-08      | 3.5E-09 | 1.5E-08 | 1.50E+00                        | 2E-08 |
| Cadmium                       | 4.12E+01          | 1.0            | 3.38E-08          | 6.39E-08 | 1.4E-06      | 2.6E-06 | 4.0E-06 | 1.00E-03           | 4E-03 | 5.79E-09            | 1.83E-09 | 2.4E-07      | 7.5E-08 | 3.1E-07 | NA                              | --    |
| Chromium(III)                 | 3.66E+00          | 1.0            | 3.38E-08          | 6.39E-08 | 1.2E-07      | 2.3E-07 | 3.6E-07 | 1.50E+00           | 2E-07 | 5.79E-09            | 1.83E-09 | 2.1E-08      | 6.7E-09 | 2.8E-08 | NA                              | --    |
| Chromium(VI)                  | 4.06E-01          | 1.0            | 3.38E-08          | 6.39E-08 | 1.4E-08      | 2.6E-08 | 4.0E-08 | 3.00E-03           | 1E-05 | 5.79E-09            | 1.83E-09 | 2.4E-09      | 7.4E-10 | 3.1E-09 | 5.00E-01                        | 6E-09 |
| Cobalt                        | 1.24E+01          | 1.0            | 3.38E-08          | 6.39E-08 | 4.2E-07      | 7.9E-07 | 1.2E-06 | 3.00E-04           | 4E-03 | 5.79E-09            | 1.83E-09 | 7.2E-08      | 2.3E-08 | 9.4E-08 | NA                              | --    |
| Copper                        | 9.33E+02          | 1.0            | 3.38E-08          | 6.39E-08 | 3.2E-05      | 6.0E-05 | 9.1E-05 | 4.00E-02           | 2E-03 | 5.79E-09            | 1.83E-09 | 5.4E-06      | 1.7E-06 | 7.1E-06 | NA                              | --    |
| Iron                          | 7.01E+04          | 1.0            | 3.38E-08          | 6.39E-08 | 2.4E-03      | 4.5E-03 | 6.9E-03 | 7.00E-01           | 1E-02 | 5.79E-09            | 1.83E-09 | 4.1E-04      | 1.3E-04 | 5.3E-04 | NA                              | --    |
| Manganese                     | 7.95E+03          | 1.0            | 3.38E-08          | 6.39E-08 | 2.7E-04      | 5.1E-04 | 7.8E-04 | 2.40E-02           | 3E-02 | 5.79E-09            | 1.83E-09 | 4.6E-05      | 1.5E-05 | 6.1E-05 | NA                              | --    |
| Thallium                      | 1.72E-01          | 1.0            | 3.38E-08          | 6.39E-08 | 5.8E-09      | 1.1E-08 | 1.7E-08 | 1.00E-05           | 2E-03 | 5.79E-09            | 1.83E-09 | 1.0E-09      | 3.1E-10 | 1.3E-09 | NA                              | --    |
| Zinc                          | 3.21E+03          | 1.0            | 3.38E-08          | 6.39E-08 | 1.1E-04      | 2.1E-04 | 3.1E-04 | 3.00E-01           | 1E-03 | 5.79E-09            | 1.83E-09 | 1.9E-05      | 5.9E-06 | 2.4E-05 | NA                              | --    |

**Incidental Ingestion of Soil**

| Chemical of Potential Concern | Csoil (mg/kg) | RBA (unitless) | Non Cancer Hazard |          |              |         |         |                    |       | Cancer Risk         |          |              |         |         |                                 |       |
|-------------------------------|---------------|----------------|-------------------|----------|--------------|---------|---------|--------------------|-------|---------------------|----------|--------------|---------|---------|---------------------------------|-------|
|                               |               |                | HIFNC (kg/kg d)   |          | DI (mg/kg d) |         |         | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) |          | DI (mg/kg d) |         |         | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
|                               |               |                | Adult             | Child    | Adult        | Child   | Total   |                    |       | Adult               | Child    | Adult        | Child   | Total   |                                 |       |
| Antimony                      | 5.08E+01      | 1.0            | 6.76E-08          | 2.60E-07 | 3.4E-06      | 1.3E-05 | 1.7E-05 | 4.00E-04           | 4E-02 | 1.16E-08            | 7.42E-09 | 5.9E-07      | 3.8E-07 | 9.6E-07 | NA                              | --    |
| Arsenic                       | 4.49E+01      | 0.07           | 6.76E-08          | 2.60E-07 | 2.1E-07      | 8.2E-07 | 1.0E-06 | 3.00E-04           | 3E-03 | 1.16E-08            | 7.42E-09 | 3.6E-08      | 2.3E-08 | 6.0E-08 | 1.50E+00                        | 9E-08 |
| Cadmium                       | 1.44E+01      | 1.0            | 6.76E-08          | 2.60E-07 | 9.7E-07      | 3.7E-06 | 4.7E-06 | 1.00E-03           | 5E-03 | 1.16E-08            | 7.42E-09 | 1.7E-07      | 1.1E-07 | 2.7E-07 | NA                              | --    |
| Chromium(III)                 | 6.63E+00      | 1.0            | 6.76E-08          | 2.60E-07 | 4.5E-07      | 1.7E-06 | 2.2E-06 | 1.50E+00           | 1E-06 | 1.16E-08            | 7.42E-09 | 7.7E-08      | 4.9E-08 | 1.3E-07 | NA                              | --    |
| Chromium(VI)                  | 7.37E-01      | 1.0            | 6.76E-08          | 2.60E-07 | 5.0E-08      | 1.9E-07 | 2.4E-07 | 3.00E-03           | 8E-05 | 1.16E-08            | 7.42E-09 | 8.5E-09      | 5.5E-09 | 1.4E-08 | 5.00E-01                        | 4E-08 |
| Cobalt                        | 1.27E+01      | 1.0            | 6.76E-08          | 2.60E-07 | 8.6E-07      | 3.3E-06 | 4.1E-06 | 3.00E-04           | 1E-02 | 1.16E-08            | 7.42E-09 | 1.5E-07      | 9.4E-08 | 2.4E-07 | NA                              | --    |
| Iron                          | 3.41E+04      | 1.0            | 6.76E-08          | 2.60E-07 | 2.3E-03      | 8.9E-03 | 1.1E-02 | 7.00E-01           | 2E-02 | 1.16E-08            | 7.42E-09 | 4.0E-04      | 2.5E-04 | 6.5E-04 | NA                              | --    |
| Manganese                     | 3.29E+03      | 1.0            | 6.76E-08          | 2.60E-07 | 2.2E-04      | 8.5E-04 | 1.1E-03 | 2.40E-02           | 4E-02 | 1.16E-08            | 7.42E-09 | 3.8E-05      | 2.4E-05 | 6.3E-05 | NA                              | --    |
| Thallium                      | 3.42E-01      | 1.0            | 6.76E-08          | 2.60E-07 | 2.3E-08      | 8.9E-08 | 1.1E-07 | 1.00E-05           | 1E-02 | 1.16E-08            | 7.42E-09 | 4.0E-09      | 2.5E-09 | 6.5E-09 | NA                              | --    |
| Zinc                          | 2.21E+03      | 1.0            | 6.76E-08          | 2.60E-07 | 1.5E-04      | 5.7E-04 | 7.2E-04 | 3.00E-01           | 2E-03 | 1.16E-08            | 7.42E-09 | 2.6E-05      | 1.6E-05 | 4.2E-05 | NA                              | --    |

**TABLE D-8a**  
**DETAILED RISK CALCULATIONS FOR THE CAMPER (DISPERSED) IN EU7**  
 Bonita Peak Mining District

**Panel B. RME Scenario**  
**Incidental Ingestion of Surface Water**

| Chemical of Potential Concern | Cwater (mg/L) | RBA (unitless) | Non Cancer Hazard |          |             |         |         |                    |       | Cancer Risk        |          |             |         |         | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
|-------------------------------|---------------|----------------|-------------------|----------|-------------|---------|---------|--------------------|-------|--------------------|----------|-------------|---------|---------|---------------------------------|-------|
|                               |               |                | HIFNC (L/kg d)    |          | DI (L/kg d) |         |         | Oral RfD (mg/kg d) | HQ    | HIFCancer (L/kg d) |          | DI (L/kg d) |         |         |                                 |       |
|                               |               |                | Adult             | Child    | Adult       | Child   | Total   |                    |       | Adult              | Child    | Adult       | Child   | Total   |                                 |       |
| Aluminum                      | 1.16E+00      | 1.0            | 1.44E-05          | 3.13E-06 | 1.7E-05     | 3.6E-06 | 2.0E-05 | 1.00E+00           | 2E-05 | 4.11E-06           | 8.95E-08 | 4.8E-06     | 1.0E-07 | 4.9E-06 | NA                              | --    |
| Antimony                      | 5.04E-03 [b]  | 1.0            | 1.44E-05          | 3.13E-06 | 7.3E-08     | 1.6E-08 | 8.8E-08 | 4.00E-04           | 2E-04 | 4.11E-06           | 8.95E-08 | 2.1E-08     | 4.5E-10 | 2.1E-08 | NA                              | --    |
| Arsenic                       | 7.67E-04      | 1.0            | 1.44E-05          | 3.13E-06 | 1.1E-08     | 2.4E-09 | 1.3E-08 | 3.00E-04           | 4E-05 | 4.11E-06           | 8.95E-08 | 3.2E-09     | 6.9E-11 | 3.2E-09 | 1.50E+00                        | 5E-09 |
| Beryllium                     | 4.63E-03 [b]  | 1.0            | 1.44E-05          | 3.13E-06 | 6.7E-08     | 1.5E-08 | 8.1E-08 | 2.00E-03           | 4E-05 | 4.11E-06           | 8.95E-08 | 1.9E-08     | 4.1E-10 | 1.9E-08 | NA                              | --    |
| Cadmium                       | 4.83E-03      | 1.0            | 1.44E-05          | 3.13E-06 | 7.0E-08     | 1.5E-08 | 8.5E-08 | 5.00E-04           | 2E-04 | 4.11E-06           | 8.95E-08 | 2.0E-08     | 4.3E-10 | 2.0E-08 | NA                              | --    |
| Chromium(III)                 | 7.88E-03      | 1.0            | 1.44E-05          | 3.13E-06 | 1.1E-07     | 2.5E-08 | 1.4E-07 | 1.50E+00           | 9E-08 | 4.11E-06           | 8.95E-08 | 3.2E-08     | 7.1E-10 | 3.3E-08 | NA                              | --    |
| Chromium(VI)                  | 8.76E-04      | 1.0            | 1.44E-05          | 3.13E-06 | 1.3E-08     | 2.7E-09 | 1.5E-08 | 3.00E-03           | 5E-06 | 4.11E-06           | 8.95E-08 | 3.6E-09     | 7.8E-11 | 3.7E-09 | 5.00E-01                        | 4E-09 |
| Cobalt                        | 3.06E-03      | 1.0            | 1.44E-05          | 3.13E-06 | 4.4E-08     | 9.6E-09 | 5.4E-08 | 3.00E-04           | 2E-04 | 4.11E-06           | 8.95E-08 | 1.3E-08     | 2.7E-10 | 1.3E-08 | NA                              | --    |
| Copper                        | 3.01E-02      | 1.0            | 1.44E-05          | 3.13E-06 | 4.3E-07     | 9.4E-08 | 5.3E-07 | 4.00E-02           | 1E-05 | 4.11E-06           | 8.95E-08 | 1.2E-07     | 2.7E-09 | 1.3E-07 | NA                              | --    |
| Iron                          | 3.09E+00      | 1.0            | 1.44E-05          | 3.13E-06 | 4.5E-05     | 9.7E-06 | 5.4E-05 | 7.00E-01           | 8E-05 | 4.11E-06           | 8.95E-08 | 1.3E-05     | 2.8E-07 | 1.3E-05 | NA                              | --    |
| Manganese                     | 8.43E-01      | 1.0            | 1.44E-05          | 3.13E-06 | 1.2E-05     | 2.6E-06 | 1.5E-05 | 2.40E-02           | 6E-04 | 4.11E-06           | 8.95E-08 | 3.5E-06     | 7.5E-08 | 3.5E-06 | NA                              | --    |
| Strontium                     | 4.92E-01      | 1.0            | 1.44E-05          | 3.13E-06 | 7.1E-06     | 1.5E-06 | 8.6E-06 | 6.00E-01           | 1E-05 | 4.11E-06           | 8.95E-08 | 2.0E-06     | 4.4E-08 | 2.1E-06 | NA                              | --    |
| Thallium                      | 1.36E-03      | 1.0            | 1.44E-05          | 3.13E-06 | 2.0E-08     | 4.3E-09 | 2.4E-08 | 1.00E-05           | 2E-03 | 4.11E-06           | 8.95E-08 | 5.6E-09     | 1.2E-10 | 5.7E-09 | NA                              | --    |
| Zinc                          | 1.18E+00      | 1.0            | 1.44E-05          | 3.13E-06 | 1.7E-05     | 3.7E-06 | 2.1E-05 | 3.00E-01           | 7E-05 | 4.11E-06           | 8.95E-08 | 4.9E-06     | 1.1E-07 | --      | NA                              | --    |

**Ingestion of Surface Water (as drinking water)**

| Chemical of Potential Concern | Cwater (mg/L) | RBA (unitless) | Non Cancer Hazard |          |             |         |         |                    |       | Cancer Risk        |          |             |         |         | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
|-------------------------------|---------------|----------------|-------------------|----------|-------------|---------|---------|--------------------|-------|--------------------|----------|-------------|---------|---------|---------------------------------|-------|
|                               |               |                | HIFNC (L/kg d)    |          | DI (L/kg d) |         |         | Oral RfD (mg/kg d) | HQ    | HIFCancer (L/kg d) |          | DI (L/kg d) |         |         |                                 |       |
|                               |               |                | Adult             | Child    | Adult       | Child   | Total   |                    |       | Adult              | Child    | Adult       | Child   | Total   |                                 |       |
| Aluminum                      | 1.16E+00      | 1.0            | 3.38E-03          | 6.39E-04 | 3.9E-03     | 7.4E-04 | 4.6E-03 | 1.00E+00           | 5E-03 | 9.65E-04           | 1.83E-05 | 1.1E-03     | 2.1E-05 | 1.1E-03 | NA                              | --    |
| Antimony                      | 5.04E-03 [b]  | 1.0            | 3.38E-03          | 6.39E-04 | 1.7E-05     | 3.2E-06 | 2.0E-05 | 4.00E-04           | 5E-02 | 9.65E-04           | 1.83E-05 | 4.9E-06     | 9.2E-08 | 5.0E-06 | NA                              | --    |
| Arsenic                       | 7.67E-04      | 1.0            | 3.38E-03          | 6.39E-04 | 2.6E-06     | 4.9E-07 | 3.1E-06 | 3.00E-04           | 1E-02 | 9.65E-04           | 1.83E-05 | 7.4E-07     | 1.4E-08 | 7.5E-07 | 1.50E+00                        | 1E-06 |
| Beryllium                     | 4.63E-03 [b]  | 1.0            | 3.38E-03          | 6.39E-04 | 1.6E-05     | 3.0E-06 | 1.9E-05 | 2.00E-03           | 9E-03 | 9.65E-04           | 1.83E-05 | 4.5E-06     | 8.5E-08 | 4.6E-06 | NA                              | --    |
| Cadmium                       | 4.83E-03      | 1.0            | 3.38E-03          | 6.39E-04 | 1.6E-05     | 3.1E-06 | 1.9E-05 | 5.00E-04           | 4E-02 | 9.65E-04           | 1.83E-05 | 4.7E-06     | 8.8E-08 | 4.7E-06 | NA                              | --    |
| Chromium(III)                 | 7.88E-03      | 1.0            | 3.38E-03          | 6.39E-04 | 2.7E-05     | 5.0E-06 | 3.2E-05 | 1.50E+00           | 2E-05 | 9.65E-04           | 1.83E-05 | 7.6E-06     | 1.4E-07 | 7.8E-06 | NA                              | --    |
| Chromium(VI)                  | 8.76E-04      | 1.0            | 3.38E-03          | 6.39E-04 | 3.0E-06     | 5.6E-07 | 3.5E-06 | 3.00E-03           | 1E-03 | 9.65E-04           | 1.83E-05 | 8.5E-07     | 1.6E-08 | 8.6E-07 | 5.00E-01                        | 9E-07 |
| Cobalt                        | 3.06E-03      | 1.0            | 3.38E-03          | 6.39E-04 | 1.0E-05     | 2.0E-06 | 1.2E-05 | 3.00E-04           | 4E-02 | 9.65E-04           | 1.83E-05 | 3.0E-06     | 5.6E-08 | 3.0E-06 | NA                              | --    |
| Copper                        | 3.01E-02      | 1.0            | 3.38E-03          | 6.39E-04 | 1.0E-04     | 1.9E-05 | 1.2E-04 | 4.00E-02           | 3E-03 | 9.65E-04           | 1.83E-05 | 2.9E-05     | 5.5E-07 | 3.0E-05 | NA                              | --    |
| Iron                          | 3.09E+00      | 1.0            | 3.38E-03          | 6.39E-04 | 1.0E-02     | 2.0E-03 | 1.2E-02 | 7.00E-01           | 2E-02 | 9.65E-04           | 1.83E-05 | 3.0E-03     | 5.6E-05 | 3.0E-03 | NA                              | --    |
| Manganese                     | 8.43E-01      | 1.0            | 3.38E-03          | 6.39E-04 | 2.8E-03     | 5.4E-04 | 3.4E-03 | 2.40E-02           | 1E-01 | 9.65E-04           | 1.83E-05 | 8.1E-04     | 1.5E-05 | 8.3E-04 | NA                              | --    |
| Strontium                     | 4.92E-01      | 1.0            | 3.38E-03          | 6.39E-04 | 1.7E-03     | 3.1E-04 | 2.0E-03 | 6.00E-01           | 3E-03 | 9.65E-04           | 1.83E-05 | 4.8E-04     | 9.0E-06 | 4.8E-04 | NA                              | --    |
| Thallium                      | 1.36E-03      | 1.0            | 3.38E-03          | 6.39E-04 | 4.6E-06     | 8.7E-07 | 5.5E-06 | 1.00E-05           | 5E-01 | 9.65E-04           | 1.83E-05 | 1.3E-06     | 2.5E-08 | 1.3E-06 | NA                              | --    |
| Zinc                          | 1.18E+00      | 1.0            | 3.38E-03          | 6.39E-04 | 4.0E-03     | 7.6E-04 | 4.8E-03 | 3.00E-01           | 2E-02 | 9.65E-04           | 1.83E-05 | 1.1E-03     | 2.2E-05 | 1.2E-03 | NA                              | --    |

**TABLE D-8a**  
**DETAILED RISK CALCULATIONS FOR THE CAMPER (DISPERSED) IN EU7**  
 Bonita Peak Mining District

**Incidental Ingestion of Sediment**

| Chemical of Potential Concern | Csediment (mg/kg) | RBA (unitless) | Non Cancer Hazard |          |              |         |         |                    |       | Cancer Risk         |          |              |         |         |                                 |       |
|-------------------------------|-------------------|----------------|-------------------|----------|--------------|---------|---------|--------------------|-------|---------------------|----------|--------------|---------|---------|---------------------------------|-------|
|                               |                   |                | HIFNC (kg/kg d)   |          | DI (mg/kg d) |         |         | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) |          | DI (mg/kg d) |         |         | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
|                               |                   |                | Adult             | Child    | Adult        | Child   | Total   |                    |       | Adult               | Child    | Adult        | Child   | Total   |                                 |       |
| Arsenic                       | 3.23E+01          | 0.06           | 1.35E-07          | 6.39E-08 | 2.6E-07      | 1.2E-07 | 3.9E-07 | 3.00E-04           | 1E-03 | 3.86E-08            | 1.83E-09 | 7.5E-08      | 3.5E-09 | 7.8E-08 | 1.50E+00                        | 1E-07 |
| Cadmium                       | 4.12E+01          | 1.0            | 1.35E-07          | 6.39E-08 | 5.6E-06      | 2.6E-06 | 8.2E-06 | 1.00E-03           | 8E-03 | 3.86E-08            | 1.83E-09 | 1.6E-06      | 7.5E-08 | 1.7E-06 | NA                              | --    |
| Chromium(III)                 | 3.66E+00          | 1.0            | 1.35E-07          | 6.39E-08 | 4.9E-07      | 2.3E-07 | 7.3E-07 | 1.50E+00           | 5E-07 | 3.86E-08            | 1.83E-09 | 1.4E-07      | 6.7E-09 | 1.5E-07 | NA                              | --    |
| Chromium(VI)                  | 4.06E-01          | 1.0            | 1.35E-07          | 6.39E-08 | 5.5E-08      | 2.6E-08 | 8.1E-08 | 3.00E-03           | 3E-05 | 3.86E-08            | 1.83E-09 | 1.6E-08      | 7.4E-10 | 1.6E-08 | 5.00E-01                        | 2E-08 |
| Cobalt                        | 1.24E+01          | 1.0            | 1.35E-07          | 6.39E-08 | 1.7E-06      | 7.9E-07 | 2.5E-06 | 3.00E-04           | 8E-03 | 3.86E-08            | 1.83E-09 | 4.8E-07      | 2.3E-08 | 5.0E-07 | NA                              | --    |
| Copper                        | 9.33E+02          | 1.0            | 1.35E-07          | 6.39E-08 | 1.3E-04      | 6.0E-05 | 1.9E-04 | 4.00E-02           | 5E-03 | 3.86E-08            | 1.83E-09 | 3.6E-05      | 1.7E-06 | 3.8E-05 | NA                              | --    |
| Iron                          | 7.01E+04          | 1.0            | 1.35E-07          | 6.39E-08 | 9.5E-03      | 4.5E-03 | 1.4E-02 | 7.00E-01           | 2E-02 | 3.86E-08            | 1.83E-09 | 2.7E-03      | 1.3E-04 | 2.8E-03 | NA                              | --    |
| Manganese                     | 7.95E+03          | 1.0            | 1.35E-07          | 6.39E-08 | 1.1E-03      | 5.1E-04 | 1.6E-03 | 2.40E-02           | 7E-02 | 3.86E-08            | 1.83E-09 | 3.1E-04      | 1.5E-05 | 3.2E-04 | NA                              | --    |
| Thallium                      | 1.72E-01          | 1.0            | 1.35E-07          | 6.39E-08 | 2.3E-08      | 1.1E-08 | 3.4E-08 | 1.00E-05           | 3E-03 | 3.86E-08            | 1.83E-09 | 6.6E-09      | 3.1E-10 | 7.0E-09 | NA                              | --    |
| Zinc                          | 3.21E+03          | 1.0            | 1.35E-07          | 6.39E-08 | 4.3E-04      | 2.1E-04 | --      | 3.00E-01           | --    | 3.86E-08            | 1.83E-09 | 1.2E-04      | 5.9E-06 | --      | NA                              | --    |

**Incidental Ingestion of Soil**

| Chemical of Potential Concern | Csoil (mg/kg) | RBA (unitless) | Non Cancer Hazard |          |              |         |         |                    |       | Cancer Risk         |          |              |         |         |                                 |       |
|-------------------------------|---------------|----------------|-------------------|----------|--------------|---------|---------|--------------------|-------|---------------------|----------|--------------|---------|---------|---------------------------------|-------|
|                               |               |                | HIFNC (kg/kg d)   |          | DI (mg/kg d) |         |         | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) |          | DI (mg/kg d) |         |         | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
|                               |               |                | Adult             | Child    | Adult        | Child   | Total   |                    |       | Adult               | Child    | Adult        | Child   | Total   |                                 |       |
| Antimony                      | 5.08E+01      | 1.0            | 2.70E-07          | 2.60E-07 | 1.4E-05      | 1.3E-05 | 2.7E-05 | 4.00E-04           | 7E-02 | 7.72E-08            | 7.42E-09 | 3.9E-06      | 3.8E-07 | 4.3E-06 | NA                              | --    |
| Arsenic                       | 4.49E+01      | 0.07           | 2.70E-07          | 2.60E-07 | 8.5E-07      | 8.2E-07 | 1.7E-06 | 3.00E-04           | 6E-03 | 7.72E-08            | 7.42E-09 | 2.4E-07      | 2.3E-08 | 2.7E-07 | 1.50E+00                        | 4E-07 |
| Cadmium                       | 1.44E+01      | 1.0            | 2.70E-07          | 2.60E-07 | 3.9E-06      | 3.7E-06 | 7.6E-06 | 1.00E-03           | 8E-03 | 7.72E-08            | 7.42E-09 | 1.1E-06      | 1.1E-07 | 1.2E-06 | NA                              | --    |
| Chromium(III)                 | 6.63E+00      | 1.0            | 2.70E-07          | 2.60E-07 | 1.8E-06      | 1.7E-06 | 3.5E-06 | 1.50E+00           | 2E-06 | 7.72E-08            | 7.42E-09 | 5.1E-07      | 4.9E-08 | 5.6E-07 | NA                              | --    |
| Chromium(VI)                  | 7.37E-01      | 1.0            | 2.70E-07          | 2.60E-07 | 2.0E-07      | 1.9E-07 | 3.9E-07 | 3.00E-03           | 1E-04 | 7.72E-08            | 7.42E-09 | 5.7E-08      | 5.5E-09 | 6.2E-08 | 5.00E-01                        | 8E-08 |
| Cobalt                        | 1.27E+01      | 1.0            | 2.70E-07          | 2.60E-07 | 3.4E-06      | 3.3E-06 | 6.7E-06 | 3.00E-04           | 2E-02 | 7.72E-08            | 7.42E-09 | 9.8E-07      | 9.4E-08 | 1.1E-06 | NA                              | --    |
| Iron                          | 3.41E+04      | 1.0            | 2.70E-07          | 2.60E-07 | 9.2E-03      | 8.9E-03 | 1.8E-02 | 7.00E-01           | 3E-02 | 7.72E-08            | 7.42E-09 | 2.6E-03      | 2.5E-04 | 2.9E-03 | NA                              | --    |
| Manganese                     | 3.29E+03      | 1.0            | 2.70E-07          | 2.60E-07 | 8.9E-04      | 8.5E-04 | 1.7E-03 | 2.40E-02           | 7E-02 | 7.72E-08            | 7.42E-09 | 2.5E-04      | 2.4E-05 | 2.8E-04 | NA                              | --    |
| Thallium                      | 3.42E-01      | 1.0            | 2.70E-07          | 2.60E-07 | 9.2E-08      | 8.9E-08 | 1.8E-07 | 1.00E-05           | 2E-02 | 7.72E-08            | 7.42E-09 | 2.6E-08      | 2.5E-09 | 2.9E-08 | NA                              | --    |
| Zinc                          | 2.21E+03      | 1.0            | 2.70E-07          | 2.60E-07 | 6.0E-04      | 5.7E-04 | 1.2E-03 | 3.00E-01           | 4E-03 | 7.72E-08            | 7.42E-09 | 1.7E-04      | 1.6E-05 | 1.9E-04 | NA                              | --    |

\*The EPC values for chromium were assumed to be 10% hexavalent chromium and 90% trivalent chromium.

Csediment = sediment concentration      L = liter  
 Csoil = soil concentration                      mg = milligram  
 Cwater = water concentration                NC = non-cancer  
 CTE = central tendency exposure            RBA = relative bioavailability  
 d = day                                                RfD = reference dose  
 DI = dietary intake                                RME = reasonable maximum exposure  
 HIF = human intake factor                    SF = slope factor  
 HQ = hazard quotient                          TWF = time-weighting factor  
 kg = kilogram

**TABLE D-8b**  
**RME RISK SUMMARY FOR THE ADULT CAMPER (DISPERSED)**  
*Bonita Peak Mining District*

**Panel A: RME Non-Cancer Risks**

| Chemical of Potential Concern | Incidental SW Ingestion | SW Ingestion (as drinking water) | Incidental Sed Ingestion | Incidental Soil Ingestion | Total HI     |
|-------------------------------|-------------------------|----------------------------------|--------------------------|---------------------------|--------------|
| Aluminum                      | 2E-05                   | 5E-03                            | --                       | --                        | 5E-03        |
| Antimony                      | 2E-04                   | 5E-02                            | --                       | 7E-02                     | 1E-01        |
| Arsenic                       | 4E-05                   | 1E-02                            | 1E-03                    | 6E-03                     | 2E-02        |
| Beryllium                     | 4E-05                   | 9E-03                            | --                       | --                        | 9E-03        |
| Cadmium                       | 2E-04                   | 4E-02                            | 8E-03                    | 8E-03                     | 5E-02        |
| Chromium(III)                 | 9E-08                   | 2E-05                            | 5E-07                    | 2E-06                     | 2E-05        |
| Chromium(VI)                  | 5E-06                   | 1E-03                            | 3E-05                    | 1E-04                     | 1E-03        |
| Cobalt                        | 2E-04                   | 4E-02                            | 8E-03                    | 2E-02                     | 7E-02        |
| Copper                        | 1E-05                   | 3E-03                            | 5E-03                    | --                        | 8E-03        |
| Iron                          | 8E-05                   | 2E-02                            | 2E-02                    | 3E-02                     | 6E-02        |
| Manganese                     | 6E-04                   | 1E-01                            | 7E-02                    | 7E-02                     | 3E-01        |
| Strontium                     | 1E-05                   | 3E-03                            | --                       | --                        | 3E-03        |
| Thallium                      | 2E-03                   | 5E-01                            | 3E-03                    | 2E-02                     | 6E-01        |
| Zinc                          | 7E-05                   | 2E-02                            | --                       | 4E-03                     | 2E-02        |
| <b>Total</b>                  | <b>4E-03</b>            | <b>9E-01</b>                     | <b>1E-01</b>             | <b>2E-01</b>              | <b>1E+00</b> |

**Panel B: RME Cancer Risks**

| Chemical of Potential Concern | Incidental SW Ingestion | SW Ingestion (as drinking water) | Incidental Sed Ingestion | Incidental Soil Ingestion | Total Risk   |
|-------------------------------|-------------------------|----------------------------------|--------------------------|---------------------------|--------------|
| Aluminum                      | --                      | --                               | --                       | --                        | --           |
| Antimony                      | --                      | --                               | --                       | --                        | --           |
| Arsenic                       | 5E-09                   | 1E-06                            | 1E-07                    | 4E-07                     | 2E-06        |
| Beryllium                     | --                      | --                               | --                       | --                        | --           |
| Cadmium                       | --                      | --                               | --                       | --                        | --           |
| Chromium(III)                 | --                      | --                               | --                       | --                        | --           |
| Chromium(VI)                  | 4E-09                   | 9E-07                            | 2E-08                    | 8E-08                     | 1E-06        |
| Cobalt                        | --                      | --                               | --                       | --                        | --           |
| Copper                        | --                      | --                               | --                       | --                        | --           |
| Iron                          | --                      | --                               | --                       | --                        | --           |
| Manganese                     | --                      | --                               | --                       | --                        | --           |
| Strontium                     | --                      | --                               | --                       | --                        | --           |
| Thallium                      | --                      | --                               | --                       | --                        | --           |
| Zinc                          | --                      | --                               | --                       | --                        | --           |
| <b>Total</b>                  | <b>9E-09</b>            | <b>2E-06</b>                     | <b>1E-07</b>             | <b>5E-07</b>              | <b>3E-06</b> |

**Notes:**

- = not calculated
- HI = hazard index
- RME = reasonable maximum exposure
- Sed = sediment
- SW = surface water

**TABLE D-9a**  
**DETAILED RISK CALCULATIONS FOR THE RECREATIONAL FISHERMAN IN EU8**  
*Bonita Peak Mining District*

**Panel A. CTE Scenario**  
**Incidental Ingestion of Surface Water**

| Chemical of Potential Concern * | Cwater (mg/L) | RBA (unitless) | Non Cancer Hazard |             |                    |       | Cancer Risk        |             |                                |       |
|---------------------------------|---------------|----------------|-------------------|-------------|--------------------|-------|--------------------|-------------|--------------------------------|-------|
|                                 |               |                | HIFNC (L/kg d)    | DI (L/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (L/kg d) | DI (L/kg d) | Oral SF (mg/kg d) <sup>1</sup> | Risk  |
| Aluminum                        | 3.35E+00      | 1.0            | 3.04E-06          | 1.0E-05     | 1.00E+00           | 1E-05 | 5.21E-07           | 1.7E-06     | NA                             | --    |
| Antimony                        | --            | [a]            | 3.04E-06          | --          | 4.00E-04           | --    | 5.21E-07           | --          | NA                             | --    |
| Arsenic                         | 2.39E-03      | 1.0            | 3.04E-06          | 7.3E-09     | 3.00E-04           | 2E-05 | 5.21E-07           | 1.2E-09     | 1.50E+00                       | 2E-09 |
| Beryllium                       | 1.65E-04      | 1.0            | 3.04E-06          | 5.0E-10     | 2.00E-03           | 3E-07 | 5.21E-07           | 8.6E-11     | NA                             | --    |
| Cadmium                         | 2.10E-03      | 1.0            | 3.04E-06          | 6.4E-09     | 5.00E-04           | 1E-05 | 5.21E-07           | 1.1E-09     | NA                             | --    |
| Chromium(III)                   | 3.60E-04      | 1.0            | 3.04E-06          | 1.1E-09     | 1.50E+00           | 7E-10 | 5.21E-07           | 1.9E-10     | NA                             | --    |
| Chromium(VI)                    | 4.00E-05      | 1.0            | 3.04E-06          | 1.2E-10     | 3.00E-03           | 4E-08 | 5.21E-07           | 2.1E-11     | 5.00E-01                       | 2E-11 |
| Cobalt                          | 7.07E-03      | 1.0            | 3.04E-06          | 2.2E-08     | 3.00E-04           | 7E-05 | 5.21E-07           | 3.7E-09     | NA                             | --    |
| Copper                          | 4.62E-02      | 1.0            | 3.04E-06          | 1.4E-07     | 4.00E-02           | 4E-06 | 5.21E-07           | 2.4E-08     | NA                             | --    |
| Iron                            | 3.21E+00      | 1.0            | 3.04E-06          | 9.8E-06     | 7.00E-01           | 1E-05 | 5.21E-07           | 1.7E-06     | NA                             | --    |
| Manganese                       | 6.20E-01      | 1.0            | 3.04E-06          | 1.9E-06     | 2.40E-02           | 8E-05 | 5.21E-07           | 3.2E-07     | NA                             | --    |
| Strontium                       | 6.83E-01      | 1.0            | 3.04E-06          | 2.1E-06     | 6.00E-01           | 3E-06 | 5.21E-07           | 3.6E-07     | NA                             | --    |
| Thallium                        | 9.11E-04      | 1.0            | 3.04E-06          | 2.8E-09     | 1.00E-05           | 3E-04 | 5.21E-07           | 4.7E-10     | NA                             | --    |
| Zinc                            | 8.44E-01      | 1.0            | 3.04E-06          | 2.6E-06     | 3.00E-01           | 9E-06 | 5.21E-07           | 4.4E-07     | NA                             | --    |

**Incidental Ingestion of Sediment**

| Chemical of Potential Concern * | Csediment (mg/kg) | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                |       |
|---------------------------------|-------------------|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|--------------------------------|-------|
|                                 |                   |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>1</sup> | Risk  |
| Arsenic                         | 1.54E+02          | 0.06           | 7.24E-08          | 6.7E-07      | 3.00E-04           | 2E-03 | 1.24E-08            | 1.1E-07      | 1.50E+00                       | 2E-07 |
| Cadmium                         | 3.72E+00          | 1.0            | 7.24E-08          | 2.7E-07      | 1.00E-03           | 3E-04 | 1.24E-08            | 4.6E-08      | NA                             | --    |
| Chromium(III)                   | 2.96E+00          | 1.0            | 7.24E-08          | 2.1E-07      | 1.50E+00           | 1E-07 | 1.24E-08            | 3.7E-08      | NA                             | --    |
| Chromium(VI)                    | 3.28E-01          | 1.0            | 7.24E-08          | 2.4E-08      | 3.00E-03           | 8E-06 | 1.24E-08            | 4.1E-09      | 5.00E-01                       | 4E-09 |
| Cobalt                          | 1.80E+01          | 1.0            | 7.24E-08          | 1.3E-06      | 3.00E-04           | 4E-03 | 1.24E-08            | 2.2E-07      | NA                             | --    |
| Copper                          | 2.59E+02          | 1.0            | 7.24E-08          | 1.9E-05      | 4.00E-02           | 5E-04 | 1.24E-08            | 3.2E-06      | NA                             | --    |
| Iron                            | 6.12E+04          | 1.0            | 7.24E-08          | 4.4E-03      | 7.00E-01           | 6E-03 | 1.24E-08            | 7.6E-04      | NA                             | --    |
| Manganese                       | 1.93E+03          | 1.0            | 7.24E-08          | 1.4E-04      | 2.40E-02           | 6E-03 | 1.24E-08            | 2.4E-05      | NA                             | --    |
| Thallium                        | 1.84E-01          | 1.0            | 7.24E-08          | 1.3E-08      | 1.00E-05           | 1E-03 | 1.24E-08            | 2.3E-09      | NA                             | --    |
| Zinc                            | 1.35E+03          | 1.0            | 7.24E-08          | 9.8E-05      | 3.00E-01           | 3E-04 | 1.24E-08            | 1.7E-05      | NA                             | --    |

**TABLE D-9a**  
**DETAILED RISK CALCULATIONS FOR THE RECREATIONAL FISHERMAN IN EU8**  
*Bonita Peak Mining District*

**Ingestion of Fish**

| Chemical of Potential Concern * | Cfish (mg/kg, wet weight) |     | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                |       |
|---------------------------------|---------------------------|-----|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|--------------------------------|-------|
|                                 |                           |     |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>1</sup> | Risk  |
| Aluminum                        | --                        | [a] | 1.0            | 2.03E-05          | --           | 1.00E+00           | --    | 3.47E-06            | --           | NA                             | --    |
| Antimony                        | --                        | [a] | 1.0            | 2.03E-05          | --           | 4.00E-04           | --    | 3.47E-06            | --           | NA                             | --    |
| Arsenic                         | 4.30E-01                  |     | 1.0            | 2.03E-05          | 8.7E-06      | 3.00E-04           | 3E-02 | 3.47E-06            | 1.5E-06      | 1.50E+00                       | 2E-06 |
| Beryllium                       | --                        | [a] | 1.0            | 2.03E-05          | --           | 2.00E-03           | --    | 3.47E-06            | --           | NA                             | --    |
| Cadmium                         | 4.48E-02                  |     | 1.0            | 2.03E-05          | 9.1E-07      | 1.00E-03           | 9E-04 | 3.47E-06            | 1.6E-07      | NA                             | --    |
| Chromium(III)                   | 7.75E-01                  |     | 1.0            | 2.03E-05          | 1.6E-05      | 1.50E+00           | 1E-05 | 3.47E-06            | 2.7E-06      | NA                             | --    |
| Chromium(VI)                    | 8.61E-02                  |     | 1.0            | 2.03E-05          | 1.7E-06      | 3.00E-03           | 6E-04 | 3.47E-06            | 3.0E-07      | 5.00E-01                       | 3E-07 |
| Copper                          | 5.37E-01                  |     | 1.0            | 2.03E-05          | 1.1E-05      | 4.00E-02           | 3E-04 | 3.47E-06            | 1.9E-06      | NA                             | --    |
| Iron                            | --                        | [a] | 1.0            | 2.03E-05          | --           | 7.00E-01           | --    | 3.47E-06            | --           | NA                             | --    |
| Manganese                       | --                        | [a] | 1.0            | 2.03E-05          | --           | 1.40E-01           | --    | 3.47E-06            | --           | NA                             | --    |
| Mercury                         | 4.55E-02                  |     | 1.0            | 2.03E-05          | 9.2E-07      | 3.00E-04           | 3E-03 | 3.47E-06            | 1.6E-07      | NA                             | --    |
| Strontium                       | 6.24E-01                  |     | 1.0            | 2.03E-05          | 1.3E-05      | 6.00E-01           | 2E-05 | 3.47E-06            | 2.2E-06      | NA                             | --    |
| Thallium                        | --                        | [a] | 1.0            | 2.03E-05          | --           | 1.00E-05           | --    | 3.47E-06            | --           | NA                             | --    |
| Zinc                            | 1.01E+01                  |     | 1.0            | 2.03E-05          | 2.0E-04      | 3.00E-01           | 7E-04 | 3.47E-06            | 3.5E-05      | NA                             | --    |

**Panel B. RME Scenario**

**Incidental Ingestion of Surface Water**

| Chemical of Potential Concern * | Cwater (mg/L) |     | RBA (unitless) | Non Cancer Hazard |             |                    |       | Cancer Risk        |             |                                |       |
|---------------------------------|---------------|-----|----------------|-------------------|-------------|--------------------|-------|--------------------|-------------|--------------------------------|-------|
|                                 |               |     |                | HIFNC (L/kg d)    | DI (L/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (L/kg d) | DI (L/kg d) | Oral SF (mg/kg d) <sup>1</sup> | Risk  |
| Aluminum                        | 3.35E+00      |     | 1.0            | 2.06E-05          | 6.9E-05     | 1.00E+00           | 7E-05 | 5.87E-06           | 2.0E-05     | NA                             | --    |
| Antimony                        | --            | [a] | 1.0            | 2.06E-05          | --          | 4.00E-04           | --    | 5.87E-06           | --          | NA                             | --    |
| Arsenic                         | 2.39E-03      |     | 1.0            | 2.06E-05          | 4.9E-08     | 3.00E-04           | 2E-04 | 5.87E-06           | 1.4E-08     | 1.50E+00                       | 2E-08 |
| Beryllium                       | 1.65E-04      |     | 1.0            | 2.06E-05          | 3.4E-09     | 2.00E-03           | 2E-06 | 5.87E-06           | 9.7E-10     | NA                             | --    |
| Cadmium                         | 2.10E-03      |     | 1.0            | 2.06E-05          | 4.3E-08     | 5.00E-04           | 9E-05 | 5.87E-06           | 1.2E-08     | NA                             | --    |
| Chromium(III)                   | 3.60E-04      |     | 1.0            | 2.06E-05          | 7.4E-09     | 1.50E+00           | 5E-09 | 5.87E-06           | 2.1E-09     | NA                             | --    |
| Chromium(VI)                    | 4.00E-05      |     | 1.0            | 2.06E-05          | 8.2E-10     | 3.00E-03           | 3E-07 | 5.87E-06           | 2.3E-10     | 5.00E-01                       | 2E-10 |
| Cobalt                          | 7.07E-03      |     | 1.0            | 2.06E-05          | 1.5E-07     | 3.00E-04           | 5E-04 | 5.87E-06           | 4.2E-08     | NA                             | --    |
| Copper                          | 4.62E-02      |     | 1.0            | 2.06E-05          | 9.5E-07     | 4.00E-02           | 2E-05 | 5.87E-06           | 2.7E-07     | NA                             | --    |
| Iron                            | 3.21E+00      |     | 1.0            | 2.06E-05          | 6.6E-05     | 7.00E-01           | 9E-05 | 5.87E-06           | 1.9E-05     | NA                             | --    |
| Manganese                       | 6.20E-01      |     | 1.0            | 2.06E-05          | 1.3E-05     | 2.40E-02           | 5E-04 | 5.87E-06           | 3.6E-06     | NA                             | --    |
| Strontium                       | 6.83E-01      |     | 1.0            | 2.06E-05          | 1.4E-05     | 6.00E-01           | 2E-05 | 5.87E-06           | 4.0E-06     | NA                             | --    |
| Thallium                        | 9.11E-04      |     | 1.0            | 2.06E-05          | 1.9E-08     | 1.00E-05           | 2E-03 | 5.87E-06           | 5.4E-09     | NA                             | --    |
| Zinc                            | 8.44E-01      |     | 1.0            | 2.06E-05          | 1.7E-05     | 3.00E-01           | 6E-05 | 5.87E-06           | 5.0E-06     | NA                             | --    |

**TABLE D-9a**  
**DETAILED RISK CALCULATIONS FOR THE RECREATIONAL FISHERMAN IN EU8**  
*Bonita Peak Mining District*

**Incidental Ingestion of Sediment**

| Chemical of Potential Concern* | Csediment (mg/kg) | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                |       |
|--------------------------------|-------------------|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|--------------------------------|-------|
|                                |                   |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>1</sup> | Risk  |
| Arsenic                        | 1.54E+02          | 0.06           | 2.90E-07          | 2.7E-06      | 3.00E-04           | 9E-03 | 8.27E-08            | 7.7E-07      | 1.50E+00                       | 1E-06 |
| Cadmium                        | 3.72E+00          | 1.0            | 2.90E-07          | 1.1E-06      | 1.00E-03           | 1E-03 | 8.27E-08            | 3.1E-07      | NA                             | --    |
| Chromium(III)                  | 2.96E+00          | 1.0            | 2.90E-07          | 8.6E-07      | 1.50E+00           | 6E-07 | 8.27E-08            | 2.4E-07      | NA                             | --    |
| Chromium(VI)                   | 3.28E-01          | 1.0            | 2.90E-07          | 9.5E-08      | 3.00E-03           | 3E-05 | 8.27E-08            | 2.7E-08      | 5.00E-01                       | 3E-08 |
| Cobalt                         | 1.80E+01          | 1.0            | 2.90E-07          | 5.2E-06      | 3.00E-04           | 2E-02 | 8.27E-08            | 1.5E-06      | NA                             | --    |
| Copper                         | 2.59E+02          | 1.0            | 2.90E-07          | 7.5E-05      | 4.00E-02           | 2E-03 | 8.27E-08            | 2.1E-05      | NA                             | --    |
| Iron                           | 6.12E+04          | 1.0            | 2.90E-07          | 1.8E-02      | 7.00E-01           | 3E-02 | 8.27E-08            | 5.1E-03      | NA                             | --    |
| Manganese                      | 1.93E+03          | 1.0            | 2.90E-07          | 5.6E-04      | 2.40E-02           | 2E-02 | 8.27E-08            | 1.6E-04      | NA                             | --    |
| Thallium                       | 1.84E-01          | 1.0            | 2.90E-07          | 5.3E-08      | 1.00E-05           | 5E-03 | 8.27E-08            | 1.5E-08      | NA                             | --    |
| Zinc                           | 1.35E+03          | 1.0            | 2.90E-07          | 3.9E-04      | 3.00E-01           | 1E-03 | 8.27E-08            | 1.1E-04      | NA                             | --    |

**Ingestion of Fish**

| Chemical of Potential Concern* | Cfish (mg/kg, wet weight) | RBA (unitless) | Non Cancer Hazard |              |                    |          | Cancer Risk         |              |                                |       |    |
|--------------------------------|---------------------------|----------------|-------------------|--------------|--------------------|----------|---------------------|--------------|--------------------------------|-------|----|
|                                |                           |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ       | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>1</sup> | Risk  |    |
| Aluminum                       | --                        | [a]            | 1.0               | 1.45E-04     | --                 | 1.00E+00 | --                  | 4.15E-05     | --                             | NA    | -- |
| Antimony                       | --                        | [a]            | 1.0               | 1.45E-04     | --                 | 4.00E-04 | --                  | 4.15E-05     | --                             | NA    | -- |
| Arsenic                        | 4.30E-01                  | 1.0            | 1.45E-04          | 6.2E-05      | 3.00E-04           | 2E-01    | 4.15E-05            | 1.8E-05      | 1.50E+00                       | 3E-05 |    |
| Beryllium                      | --                        | [a]            | 1.0               | 1.45E-04     | --                 | 2.00E-03 | --                  | 4.15E-05     | --                             | NA    | -- |
| Cadmium                        | 4.48E-02                  | 1.0            | 1.45E-04          | 6.5E-06      | 1.00E-03           | 7E-03    | 4.15E-05            | 1.9E-06      | NA                             | --    |    |
| Chromium(III)                  | 7.75E-01                  | 1.0            | 1.45E-04          | 1.1E-04      | 1.50E+00           | 8E-05    | 4.15E-05            | 3.2E-05      | NA                             | --    |    |
| Chromium(VI)                   | 8.61E-02                  | 1.0            | 1.45E-04          | 1.3E-05      | 3.00E-03           | 4E-03    | 4.15E-05            | 3.6E-06      | 5.00E-01                       | 4E-06 |    |
| Copper                         | 5.37E-01                  | 1.0            | 1.45E-04          | 7.8E-05      | 4.00E-02           | 2E-03    | 4.15E-05            | 2.2E-05      | NA                             | --    |    |
| Iron                           | --                        | [a]            | 1.0               | 1.45E-04     | --                 | 7.00E-01 | --                  | 4.15E-05     | --                             | NA    | -- |
| Manganese                      | --                        | [a]            | 1.0               | 1.45E-04     | --                 | 1.40E-01 | --                  | 4.15E-05     | --                             | NA    | -- |
| Mercury                        | 4.55E-02                  | 2.0            | 1.45E-04          | 1.3E-05      | 3.00E-04           | 4E-02    | 4.15E-05            | 3.8E-06      | NA                             | --    |    |
| Strontium                      | 6.24E-01                  | 1.0            | 1.45E-04          | 9.1E-05      | 6.00E-01           | 2E-04    | 4.15E-05            | 2.6E-05      | NA                             | --    |    |
| Thallium                       | --                        | [a]            | 1.0               | 1.45E-04     | --                 | 1.00E-05 | --                  | 4.15E-05     | --                             | NA    | -- |
| Zinc                           | 1.01E+01                  | 1.0            | 1.45E-04          | 1.5E-03      | 3.00E-01           | 5E-03    | 4.15E-05            | 4.2E-04      | NA                             | --    |    |

\*The EPC values for chromium were assumed to be 10% hexavalent chromium and 90% trivalent chromium.

Csediment = sediment concentration      L = liter      NA = not available  
Cwater = surface water concentration      mg = milligram      -- = not calculated  
Cfish = fish tissue concentration      NC = non-cancer  
CTE = cental tendency exposure      RBA = relative bioavailability  
d = day      RfD = reference dose  
DI = dietary intake      RME = reasonable maximum exposure  
HIF = human intake factor      SF = slope factor  
HQ = hazard quotient  
kg = kilogram

**TABLE D-10a**  
**DETAILED RISK CALCULATIONS FOR THE RECREATIONAL FISHERMAN IN EU9**  
*Bonita Peak Mining District*

**Panel A. CTE Scenario**  
**Incidental Ingestion of Surface Water**

| Chemical of Potential Concern | Cwater (mg/L) | RBA (unitless) | Non Cancer Hazard |             |                    |       | Cancer Risk        |             |                                |       |
|-------------------------------|---------------|----------------|-------------------|-------------|--------------------|-------|--------------------|-------------|--------------------------------|-------|
|                               |               |                | HIFNC (L/kg d)    | DI (L/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (L/kg d) | DI (L/kg d) | Oral SF (mg/kg d) <sup>1</sup> | Risk  |
| Aluminum                      | 3.21E-01      | 1.0            | 3.04E-06          | 9.8E-07     | 1.00E+00           | 1E-06 | 5.21E-07           | 1.7E-07     | NA                             | --    |
| Antimony                      | 5.04E-03 [b]  | 1.0            | 3.04E-06          | 1.5E-08     | 4.00E-04           | 4E-05 | 5.21E-07           | 2.6E-09     | NA                             | --    |
| Arsenic                       | 2.06E-04      | 1.0            | 3.04E-06          | 6.3E-10     | 3.00E-04           | 2E-06 | 5.21E-07           | 1.1E-10     | 1.50E+00                       | 2E-10 |
| Beryllium                     | 3.15E-04      | 1.0            | 3.04E-06          | 9.6E-10     | 2.00E-03           | 5E-07 | 5.21E-07           | 1.6E-10     | NA                             | --    |
| Cadmium                       | 2.18E-03      | 1.0            | 3.04E-06          | 6.6E-09     | 5.00E-04           | 1E-05 | 5.21E-07           | 1.1E-09     | NA                             | --    |
| Chromium(III)                 | 1.62E-03      | 1.0            | 3.04E-06          | 4.9E-09     | 1.50E+00           | 3E-09 | 5.21E-07           | 8.4E-10     | NA                             | --    |
| Chromium(VI)                  | 1.80E-04      | 1.0            | 3.04E-06          | 5.5E-10     | 3.00E-03           | 2E-07 | 5.21E-07           | 9.4E-11     | 5.00E-01                       | 9E-11 |
| Cobalt                        | 4.71E-04      | 1.0            | 3.04E-06          | 1.4E-09     | 3.00E-04           | 5E-06 | 5.21E-07           | 2.5E-10     | NA                             | --    |
| Copper                        | 1.51E-02      | 1.0            | 3.04E-06          | 4.6E-08     | 4.00E-02           | 1E-06 | 5.21E-07           | 7.8E-09     | NA                             | --    |
| Iron                          | 6.23E-01      | 1.0            | 3.04E-06          | 1.9E-06     | 7.00E-01           | 3E-06 | 5.21E-07           | 3.2E-07     | NA                             | --    |
| Manganese                     | 2.18E+00      | 1.0            | 3.04E-06          | 6.6E-06     | 2.40E-02           | 3E-04 | 5.21E-07           | 1.1E-06     | NA                             | --    |
| Strontium                     | 4.25E-01      | 1.0            | 3.04E-06          | 1.3E-06     | 6.00E-01           | 2E-06 | 5.21E-07           | 2.2E-07     | NA                             | --    |
| Thallium                      | 1.71E-03      | 1.0            | 3.04E-06          | 5.2E-09     | 1.00E-05           | 5E-04 | 5.21E-07           | 8.9E-10     | NA                             | --    |
| Zinc                          | 1.03E+00      | 1.0            | 3.04E-06          | 3.1E-06     | 3.00E-01           | 1E-05 | 5.21E-07           | 5.3E-07     | NA                             | --    |

**Incidental Ingestion of Sediment**

| Chemical of Potential Concern | Csed (mg/kg) | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                |       |
|-------------------------------|--------------|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|--------------------------------|-------|
|                               |              |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>1</sup> | Risk  |
| Arsenic                       | 3.76E+01     | 0.06           | 7.24E-08          | 1.6E-07      | 3.00E-04           | 5E-04 | 1.24E-08            | 2.8E-08      | 1.50E+00                       | 4E-08 |
| Cadmium                       | 1.24E+01     | 1.0            | 7.24E-08          | 9.0E-07      | 1.00E-03           | 9E-04 | 1.24E-08            | 1.5E-07      | NA                             | --    |
| Chromium(III)                 | 5.01E+00     | 1.0            | 7.24E-08          | 3.6E-07      | 1.50E+00           | 2E-07 | 1.24E-08            | 6.2E-08      | NA                             | --    |
| Chromium(VI)                  | 5.57E-01     | 1.0            | 7.24E-08          | 4.0E-08      | 3.00E-03           | 1E-05 | 1.24E-08            | 6.9E-09      | 5.00E-01                       | 7E-09 |
| Cobalt                        | 1.25E+01     | 1.0            | 7.24E-08          | 9.0E-07      | 3.00E-04           | 3E-03 | 1.24E-08            | 1.6E-07      | NA                             | --    |
| Copper                        | 6.01E+02     | 1.0            | 7.24E-08          | 4.3E-05      | 4.00E-02           | 1E-03 | 1.24E-08            | 7.5E-06      | NA                             | --    |
| Iron                          | 2.78E+04     | 1.0            | 7.24E-08          | 2.0E-03      | 7.00E-01           | 3E-03 | 1.24E-08            | 3.4E-04      | NA                             | --    |
| Manganese                     | 1.35E+04     | 1.0            | 7.24E-08          | 9.8E-04      | 2.40E-02           | 4E-02 | 1.24E-08            | 1.7E-04      | NA                             | --    |
| Thallium                      | 1.83E+01     | 1.0            | 2.90E-07          | 5.3E-06      | 1.00E-05           | 5E-01 | 8.27E-08            | 1.5E-06      | NA                             | --    |
| Zinc                          | 2.94E+03     | 1.0            | 7.24E-08          | 2.1E-04      | 3.00E-01           | 7E-04 | 1.24E-08            | 3.6E-05      | NA                             | --    |

**TABLE D-10a**  
**DETAILED RISK CALCULATIONS FOR THE RECREATIONAL FISHERMAN IN EU9**  
*Bonita Peak Mining District*

**Ingestion of Fish**

| Chemical of Potential Concern | Cfish (mg/kg, wet weight) |     | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|-------------------------------|---------------------------|-----|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                               |                           |     |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Aluminum                      | --                        | [a] | 1.0            | 2.03E-05          | --           | 1.00E+00           | --    | 3.47E-06            | --           | NA                              | --    |
| Antimony                      | --                        | [a] | 1.0            | 2.03E-05          | --           | 4.00E-04           | --    | 3.47E-06            | --           | NA                              | --    |
| Arsenic                       | --                        | [a] | 1.0            | 2.03E-05          | --           | 3.00E-04           | --    | 3.47E-06            | --           | 1.50E+00                        | --    |
| Beryllium                     | --                        | [a] | 1.0            | 2.03E-05          | --           | 2.00E-03           | --    | 3.47E-06            | --           | NA                              | --    |
| Cadmium                       | 8.14E-02                  | [c] | 1.0            | 2.03E-05          | 1.6E-06      | 1.00E-03           | 2E-03 | 3.47E-06            | 2.8E-07      | NA                              | --    |
| Chromium(III)                 | 1.14E+00                  |     | 1.0            | 2.03E-05          | 2.3E-05      | 1.50E+00           | 2E-05 | 3.47E-06            | 4.0E-06      | NA                              | --    |
| Chromium(VI)                  | 1.27E-01                  |     | 1.0            | 2.03E-05          | 2.6E-06      | 3.00E-03           | 9E-04 | 3.47E-06            | 4.4E-07      | 5.00E-01                        | 4E-07 |
| Copper                        | 5.83E-01                  |     | 1.0            | 2.03E-05          | 1.2E-05      | 4.00E-02           | 3E-04 | 3.47E-06            | 2.0E-06      | NA                              | --    |
| Iron                          | --                        | [a] | 1.0            | 2.03E-05          | --           | 7.00E-01           | --    | 3.47E-06            | --           | NA                              | --    |
| Manganese                     | 3.62E-01                  |     | 1.0            | 2.03E-05          | 7.3E-06      | 1.40E-01           | 5E-05 | 3.47E-06            | 1.3E-06      | NA                              | --    |
| Mercury                       | 2.53E-02                  |     | 1.0            | 2.03E-05          | 5.1E-07      | 3.00E-04           | 2E-03 | 3.47E-06            | 8.8E-08      | NA                              | --    |
| Strontium                     | 7.12E-01                  |     | 1.0            | 2.03E-05          | 1.4E-05      | 6.00E-01           | 2E-05 | 3.47E-06            | 2.5E-06      | NA                              | --    |
| Thallium                      | --                        | [a] | 1.0            | 2.03E-05          | --           | 1.00E-05           | --    | 3.47E-06            | --           | NA                              | --    |
| Zinc                          | 1.81E+01                  |     | 1.0            | 2.03E-05          | 3.7E-04      | 3.00E-01           | 1E-03 | 3.47E-06            | 6.3E-05      | NA                              | --    |

**Panel B. RME Scenario**

**Incidental Ingestion of Surface Water**

| Chemical of Potential Concern | Cwater (mg/L) | RBA (unitless) | Non Cancer Hazard |             |                    |          | Cancer Risk        |             |                                 |          |       |
|-------------------------------|---------------|----------------|-------------------|-------------|--------------------|----------|--------------------|-------------|---------------------------------|----------|-------|
|                               |               |                | HIFNC (L/kg d)    | DI (L/kg d) | Oral RfD (mg/kg d) | HQ       | HIFCancer (L/kg d) | DI (L/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk     |       |
| Aluminum                      | 3.21E-01      |                | 1.0               | 2.06E-05    | 6.6E-06            | 1.00E+00 | 7E-06              | 5.87E-06    | 1.9E-06                         | NA       | --    |
| Antimony                      | 5.04E-03      | [b]            | 1.0               | 2.06E-05    | 1.0E-07            | 4.00E-04 | 3E-04              | 5.87E-06    | 3.0E-08                         | NA       | --    |
| Arsenic                       | 2.06E-04      |                | 1.0               | 2.06E-05    | 4.2E-09            | 3.00E-04 | 1E-05              | 5.87E-06    | 1.2E-09                         | 1.50E+00 | 2E-09 |
| Beryllium                     | 3.15E-04      |                | 1.0               | 2.06E-05    | 6.5E-09            | 2.00E-03 | 3E-06              | 5.87E-06    | 1.9E-09                         | NA       | --    |
| Cadmium                       | 2.18E-03      |                | 1.0               | 2.06E-05    | 4.5E-08            | 5.00E-04 | 9E-05              | 5.87E-06    | 1.3E-08                         | NA       | --    |
| Chromium(III)                 | 1.62E-03      |                | 1.0               | 2.06E-05    | 3.3E-08            | 1.50E+00 | 2E-08              | 5.87E-06    | 9.5E-09                         | NA       | --    |
| Chromium(VI)                  | 1.80E-04      |                | 1.0               | 2.06E-05    | 3.7E-09            | 3.00E-03 | 1E-06              | 5.87E-06    | 1.1E-09                         | 5.00E-01 | 1E-09 |
| Cobalt                        | 4.71E-04      |                | 1.0               | 2.06E-05    | 9.7E-09            | 3.00E-04 | 3E-05              | 5.87E-06    | 2.8E-09                         | NA       | --    |
| Copper                        | 1.51E-02      |                | 1.0               | 2.06E-05    | 3.1E-07            | 4.00E-02 | 8E-06              | 5.87E-06    | 8.8E-08                         | NA       | --    |
| Iron                          | 6.23E-01      |                | 1.0               | 2.06E-05    | 1.3E-05            | 7.00E-01 | 2E-05              | 5.87E-06    | 3.7E-06                         | NA       | --    |
| Manganese                     | 2.18E+00      |                | 1.0               | 2.06E-05    | 4.5E-05            | 2.40E-02 | 2E-03              | 5.87E-06    | 1.3E-05                         | NA       | --    |
| Strontium                     | 4.25E-01      |                | 1.0               | 2.06E-05    | 8.7E-06            | 6.00E-01 | 1E-05              | 5.87E-06    | 2.5E-06                         | NA       | --    |
| Thallium                      | 1.71E-03      |                | 1.0               | 2.06E-05    | 3.5E-08            | 1.00E-05 | 4E-03              | 5.87E-06    | 1.0E-08                         | NA       | --    |
| Zinc                          | 1.03E+00      |                | 1.0               | 2.06E-05    | 2.1E-05            | 3.00E-01 | 7E-05              | 5.87E-06    | 6.0E-06                         | NA       | --    |

**TABLE D-10a**  
**DETAILED RISK CALCULATIONS FOR THE RECREATIONAL FISHERMAN IN EU9**  
*Bonita Peak Mining District*

**Incidental Ingestion of Sediment**

| Chemical of Potential Concern* | Csediment (mg/kg) | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|--------------------------------|-------------------|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                |                   |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Arsenic                        | 3.76E+01          | 0.06           | 2.90E-07          | 6.5E-07      | 3.00E-04           | 2E-03 | 8.27E-08            | 1.9E-07      | 1.50E+00                        | 3E-07 |
| Cadmium                        | 1.24E+01          | 1.0            | 2.90E-07          | 3.6E-06      | 1.00E-03           | 4E-03 | 8.27E-08            | 1.0E-06      | NA                              | --    |
| Chromium(III)                  | 5.01E+00          | 1.0            | 2.90E-07          | 1.5E-06      | 1.50E+00           | 1E-06 | 8.27E-08            | 4.1E-07      | NA                              | --    |
| Chromium(VI)                   | 5.57E-01          | 1.0            | 2.90E-07          | 1.6E-07      | 3.00E-03           | 5E-05 | 8.27E-08            | 4.6E-08      | 5.00E-01                        | 5E-08 |
| Cobalt                         | 1.25E+01          | 1.0            | 2.90E-07          | 3.6E-06      | 3.00E-04           | 1E-02 | 8.27E-08            | 1.0E-06      | NA                              | --    |
| Copper                         | 6.01E+02          | 1.0            | 2.90E-07          | 1.7E-04      | 4.00E-02           | 4E-03 | 8.27E-08            | 5.0E-05      | NA                              | --    |
| Iron                           | 2.78E+04          | 1.0            | 2.90E-07          | 8.0E-03      | 7.00E-01           | 1E-02 | 8.27E-08            | 2.3E-03      | NA                              | --    |
| Manganese                      | 1.35E+04          | 1.0            | 2.90E-07          | 3.9E-03      | 2.40E-02           | 2E-01 | 8.27E-08            | 1.1E-03      | NA                              | --    |
| Thallium                       | 1.83E+01          | 1.0            | 2.90E-07          | 5.3E-06      | 1.00E-05           | 5E-01 | 8.27E-08            | 1.5E-06      | NA                              | --    |
| Zinc                           | 2.94E+03          | 1.0            | 2.90E-07          | 8.5E-04      | 3.00E-01           | 3E-03 | 8.27E-08            | 2.4E-04      | NA                              | --    |

**Ingestion of Fish**

| Chemical of Potential Concern* | Cfish (mg/kg, wet weight) | RBA (unitless) | Non Cancer Hazard |              |                    |          | Cancer Risk         |              |                                 |          |       |
|--------------------------------|---------------------------|----------------|-------------------|--------------|--------------------|----------|---------------------|--------------|---------------------------------|----------|-------|
|                                |                           |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ       | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk     |       |
| Aluminum                       | --                        | [a]            | 1.0               | 1.45E-04     | --                 | 1.00E+00 | --                  | 4.15E-05     | --                              | NA       | --    |
| Antimony                       | --                        | [a]            | 1.0               | 1.45E-04     | --                 | 4.00E-04 | --                  | 4.15E-05     | --                              | NA       | --    |
| Arsenic                        | --                        | [a]            | 1.0               | 1.45E-04     | --                 | 3.00E-04 | --                  | 4.15E-05     | --                              | 1.50E+00 | --    |
| Beryllium                      | --                        | [a]            | 1.0               | 1.45E-04     | --                 | 2.00E-03 | --                  | 4.15E-05     | --                              | NA       | --    |
| Cadmium                        | 8.14E-02                  | [c]            | 1.0               | 1.45E-04     | 1.2E-05            | 1.00E-03 | 1E-02               | 4.15E-05     | 3.4E-06                         | NA       | --    |
| Chromium(III)                  | 1.14E+00                  |                | 1.0               | 1.45E-04     | 1.7E-04            | 1.50E+00 | 1E-04               | 4.15E-05     | 4.7E-05                         | NA       | --    |
| Chromium(VI)                   | 1.27E-01                  |                | 1.0               | 1.45E-04     | 1.8E-05            | 3.00E-03 | 6E-03               | 4.15E-05     | 5.3E-06                         | 5.00E-01 | 5E-06 |
| Copper                         | 5.83E-01                  |                | 1.0               | 1.45E-04     | 8.5E-05            | 4.00E-02 | 2E-03               | 4.15E-05     | 2.4E-05                         | NA       | --    |
| Iron                           | --                        | [a]            | 1.0               | 1.45E-04     | --                 | 7.00E-01 | --                  | 4.15E-05     | --                              | NA       | --    |
| Manganese                      | 3.62E-01                  |                | 1.0               | 1.45E-04     | 5.3E-05            | 1.40E-01 | 4E-04               | 4.15E-05     | 1.5E-05                         | NA       | --    |
| Mercury                        | 2.53E-02                  |                | 2.0               | 1.45E-04     | 7.3E-06            | 3.00E-04 | 2E-02               | 4.15E-05     | 2.1E-06                         | NA       | --    |
| Strontium                      | 7.12E-01                  |                | 1.0               | 1.45E-04     | 1.0E-04            | 6.00E-01 | 2E-04               | 4.15E-05     | 3.0E-05                         | NA       | --    |
| Thallium                       | --                        | [a]            | 1.0               | 1.45E-04     | --                 | 1.00E-05 | --                  | 4.15E-05     | --                              | NA       | --    |
| Zinc                           | 1.81E+01                  |                | 1.0               | 1.45E-04     | 2.6E-03            | 3.00E-01 | 9E-03               | 4.15E-05     | 7.5E-04                         | NA       | --    |

\*The EPC values for chromium were assumed to be 10% hexavalent chromium and 90% trivalent chromium.

Csediment = sediment concentration      L = liter      NA = not available  
Cwater = surface water concentration      mg = milligram      -- = not calculated  
Cfish = fish tissue concentration      NC = non-cancer  
CTE = cental tendency exposure      RBA = relative bioavailability  
d = day      RfD = reference dose  
DI = dietary intake      RME = reasonable maximum exposure  
HIF = human intake factor      SF = slope factor  
HQ = hazard quotient  
kg = kilogram

**TABLE D-10b**  
**RME RISK SUMMARY FOR THE RECREATIONAL FISHERMAN**  
*Bonita Peak Mining District*

**Panel A: RME Non-Cancer Risks**

| Chemical of Potential Concern | EU8 (Mineral Creek)     |                          |                |              | EU9 (Animas River)      |                          |                |              |
|-------------------------------|-------------------------|--------------------------|----------------|--------------|-------------------------|--------------------------|----------------|--------------|
|                               | Incidental SW Ingestion | Incidental Sed Ingestion | Fish Ingestion | Total HI     | Incidental SW Ingestion | Incidental Sed Ingestion | Fish Ingestion | Total HI     |
| Aluminum                      | 7E-05                   | --                       | --             | 7E-05        | 7E-06                   | --                       | --             | 7E-06        |
| Antimony                      | --                      | --                       | --             | --           | 3E-04                   | --                       | --             | 3E-04        |
| Arsenic                       | 2E-04                   | 9E-03                    | 2E-01          | 2E-01        | 1E-05                   | 2E-03                    | --             | 2E-03        |
| Beryllium                     | 2E-06                   | --                       | --             | --           | 3E-06                   | --                       | --             | 3E-06        |
| Cadmium                       | 9E-05                   | 1E-03                    | 7E-03          | 8E-03        | 9E-05                   | 4E-03                    | 1E-02          | 2E-02        |
| Chromium(III)                 | 5E-09                   | 6E-07                    | 8E-05          | 8E-05        | 2E-08                   | 1E-06                    | 1E-04          | 1E-04        |
| Chromium(VI)                  | 3E-07                   | 3E-05                    | 4E-03          | 4E-03        | 1E-06                   | 5E-05                    | 6E-03          | 6E-03        |
| Cobalt                        | 5E-04                   | 2E-02                    | --             | 2E-02        | 3E-05                   | 1E-02                    | --             | 1E-02        |
| Copper                        | 2E-05                   | 2E-03                    | 2E-03          | 4E-03        | 8E-06                   | 4E-03                    | 2E-03          | 6E-03        |
| Iron                          | 9E-05                   | 3E-02                    | --             | 3E-02        | 2E-05                   | 1E-02                    | --             | 1E-02        |
| Manganese                     | 5E-04                   | 2E-02                    | --             | 2E-02        | 2E-03                   | 2E-01                    | 4E-04          | 2E-01        |
| Mercury                       | --                      | --                       | 4E-02          | 4E-02        | --                      | --                       | 2E-02          | 2E-02        |
| Thallium                      | 2E-05                   | 5E-03                    | 2E-04          | 6E-03        | 1E-05                   | 5E-01                    | 2E-04          | 5E-01        |
| Strontium                     | 2E-03                   | --                       | --             | 2E-03        | 4E-03                   | --                       | --             | 4E-03        |
| Zinc                          | 6E-05                   | 1E-03                    | 5E-03          | 6E-03        | 7E-05                   | 3E-03                    | 9E-03          | 1E-02        |
| <b>Total</b>                  | <b>3E-03</b>            | <b>8E-02</b>             | <b>3E-01</b>   | <b>4E-01</b> | <b>6E-03</b>            | <b>7E-01</b>             | <b>5E-02</b>   | <b>8E-01</b> |

**Panel B: RME Cancer Risks**

| Chemical of Potential Concern | EU8 (Mineral Creek)     |                          |                |              | EU9 (Animas River)      |                          |                |              |
|-------------------------------|-------------------------|--------------------------|----------------|--------------|-------------------------|--------------------------|----------------|--------------|
|                               | Incidental SW Ingestion | Incidental Sed Ingestion | Fish Ingestion | Total Risk   | Incidental SW Ingestion | Incidental Sed Ingestion | Fish Ingestion | Total HI     |
| Aluminum                      | --                      | --                       | --             | --           | --                      | --                       | --             | --           |
| Antimony                      | --                      | --                       | --             | --           | --                      | --                       | --             | --           |
| Arsenic                       | 2E-08                   | 1E-06                    | 3E-05          | 3E-05        | 2E-09                   | 3E-07                    | --             | 3E-07        |
| Beryllium                     | --                      | --                       | --             | --           | --                      | --                       | --             | --           |
| Cadmium                       | --                      | --                       | --             | --           | --                      | --                       | --             | --           |
| Chromium(III)                 | --                      | --                       | --             | --           | --                      | --                       | --             | --           |
| Chromium(VI)                  | 2E-10                   | 3E-08                    | 4E-06          | 4E-06        | 1E-09                   | 5E-08                    | 5E-06          | 5E-06        |
| Cobalt                        | --                      | --                       | --             | --           | --                      | --                       | --             | --           |
| Copper                        | --                      | --                       | --             | --           | --                      | --                       | --             | --           |
| Iron                          | --                      | --                       | --             | --           | --                      | --                       | --             | --           |
| Manganese                     | --                      | --                       | --             | --           | --                      | --                       | --             | --           |
| Mercury                       | --                      | --                       | --             | --           | --                      | --                       | --             | --           |
| Thallium                      | --                      | --                       | --             | --           | --                      | --                       | --             | --           |
| Strontium                     | --                      | --                       | --             | --           | --                      | --                       | --             | --           |
| Zinc                          | --                      | --                       | --             | --           | --                      | --                       | --             | --           |
| <b>Total</b>                  | <b>2E-08</b>            | <b>1E-06</b>             | <b>3E-05</b>   | <b>3E-05</b> | <b>3E-09</b>            | <b>3E-07</b>             | <b>5E-06</b>   | <b>6E-06</b> |

**Notes:**

- = not calculated
- HI = hazard index
- RME = reasonable maximum exposure
- Sed = sediment
- SW = surface water

**TABLE D-11a**  
**DETAILED RISK CALCULATIONS FOR THE HUNTER IN EU1**  
*Bonita Peak Mining District*

**Panel A. CTE Scenario**  
**Ingestion of Grouse**

| Chemical of Potential Concern * | Ctissue (mg/kg, wet weight) |     | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|-----------------------------|-----|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |                             |     |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | --                          | [a] | 1.0            | 3.42E-05          | --           | 4.00E-04           | --    | 5.87E-06            | --           | NA                              | --    |
| Arsenic                         | --                          | [a] | 1.0            | 3.42E-05          | --           | 3.00E-04           | --    | 5.87E-06            | --           | 1.50E+00                        | --    |
| Cadmium                         | 2.31E-02                    | [b] | 1.0            | 3.42E-05          | 7.9E-07      | 1.00E-03           | 8E-04 | 5.87E-06            | 1.4E-07      | NA                              | --    |
| Chromium(III)                   | 8.03E-01                    |     | 1.0            | 3.42E-05          | 2.7E-05      | 1.50E+00           | 2E-05 | 5.87E-06            | 4.7E-06      | NA                              | --    |
| Chromium(VI)                    | 8.92E-02                    |     | 1.0            | 3.42E-05          | 3.1E-06      | 3.00E-03           | 1E-03 | 5.87E-06            | 5.2E-07      | 5.00E-01                        | 5E-07 |
| Cobalt                          | --                          | [a] | 1.0            | 3.42E-05          | --           | 3.00E-04           | --    | 5.87E-06            | --           | NA                              | --    |
| Iron                            | --                          | [a] | 1.0            | 3.42E-05          | --           | 7.00E-01           | --    | 5.87E-06            | --           | NA                              | --    |
| Manganese                       | --                          | [a] | 1.0            | 3.42E-05          | --           | 1.40E-01           | --    | 5.87E-06            | --           | NA                              | --    |
| Mercury                         | --                          | [a] | 1.0            | 3.42E-05          | --           | 3.00E-04           | --    | 5.87E-06            | --           | NA                              | --    |
| Thallium                        | --                          | [a] | 1.0            | 3.42E-05          | --           | 1.00E-05           | --    | 5.87E-06            | --           | NA                              | --    |
| Zinc                            | 4.92E+00                    | [c] | 1.0            | 3.42E-05          | 1.7E-04      | 3.00E-01           | 6E-04 | 5.87E-06            | 2.9E-05      | NA                              | --    |

**Ingestion of Deer**

| Chemical of Potential Concern * | Ctissue (mg/kg, wet weight) |     | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|-----------------------------|-----|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |                             |     |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | --                          | [a] | 1.0            | 2.74E-04          | --           | 4.00E-04           | --    | 4.69E-05            | --           | NA                              | --    |
| Arsenic                         | --                          | [a] | 1.0            | 2.74E-04          | --           | 3.00E-04           | --    | 4.69E-05            | --           | 1.50E+00                        | --    |
| Cadmium                         | --                          | [a] | 1.0            | 2.74E-04          | --           | 1.00E-03           | --    | 4.69E-05            | --           | NA                              | --    |
| Chromium(III)                   | 6.98E-01                    |     | 1.0            | 2.74E-04          | 1.9E-04      | 1.50E+00           | 1E-04 | 4.69E-05            | 3.3E-05      | NA                              | --    |
| Chromium(VI)                    | 7.76E-02                    |     | 1.0            | 2.74E-04          | 2.1E-05      | 3.00E-03           | 7E-03 | 4.69E-05            | 3.6E-06      | 5.00E-01                        | 4E-06 |
| Cobalt                          | --                          | [a] | 1.0            | 2.74E-04          | --           | 3.00E-04           | --    | 4.69E-05            | --           | NA                              | --    |
| Iron                            | 2.95E+01                    |     | 1.0            | 2.74E-04          | 8.1E-03      | 7.00E-01           | 1E-02 | 4.69E-05            | 1.4E-03      | NA                              | --    |
| Manganese                       | 3.45E-01                    | [b] | 1.0            | 2.74E-04          | 9.4E-05      | 1.40E-01           | 7E-04 | 4.69E-05            | 1.6E-05      | NA                              | --    |
| Mercury                         | --                          | [a] | 1.0            | 2.74E-04          | --           | 3.00E-04           | --    | 4.69E-05            | --           | NA                              | --    |
| Thallium                        | --                          | [a] | 1.0            | 2.74E-04          | --           | 1.00E-05           | --    | 4.69E-05            | --           | NA                              | --    |
| Zinc                            | 4.08E+01                    |     | 1.0            | 2.74E-04          | 1.1E-02      | 3.00E-01           | 4E-02 | 4.69E-05            | 1.9E-03      | NA                              | --    |

**TABLE D-11a**  
**DETAILED RISK CALCULATIONS FOR THE HUNTER IN EU1**

*Bonita Peak Mining District*

**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|---------------|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |               |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | 2.85E+00      | 1.0            | 2.41E-08          | 6.9E-08      | 4.00E-04           | 2E-04 | 4.14E-09            | 1.2E-08      | NA                              | --    |
| Arsenic                         | 4.28E+01      | **             | 2.41E-08          | 1.0E-06      | 3.00E-04           | 3E-03 | 4.14E-09            | 1.8E-07      | 1.50E+00                        | 3E-07 |
| Cadmium                         | 1.42E+01      | 1.0            | 2.41E-08          | 3.4E-07      | 1.00E-03           | 3E-04 | 4.14E-09            | 5.9E-08      | NA                              | --    |
| Chromium(III)                   | 2.65E+00      | 1.0            | 2.41E-08          | 6.4E-08      | 1.50E+00           | 4E-08 | 4.14E-09            | 1.1E-08      | NA                              | --    |
| Chromium(VI)                    | 2.95E-01      | 1.0            | 2.41E-08          | 7.1E-09      | 3.00E-03           | 2E-06 | 4.14E-09            | 1.2E-09      | 5.00E-01                        | 1E-09 |
| Cobalt                          | 9.79E+00      | 1.0            | 2.41E-08          | 2.4E-07      | 3.00E-04           | 8E-04 | 4.14E-09            | 4.0E-08      | NA                              | --    |
| Iron                            | 2.02E+04      | 1.0            | 2.41E-08          | 4.9E-04      | 7.00E-01           | 7E-04 | 4.14E-09            | 8.4E-05      | NA                              | --    |
| Manganese                       | 5.89E+03      | 1.0            | 2.41E-08          | 1.4E-04      | 2.40E-02           | 6E-03 | 4.14E-09            | 2.4E-05      | NA                              | --    |
| Thallium                        | 3.68E-01      | 1.0            | 2.41E-08          | 8.9E-09      | 1.00E-05           | 9E-04 | 4.14E-09            | 1.5E-09      | NA                              | --    |
| Zinc                            | 1.12E+03      | 1.0            | 2.41E-08          | 2.7E-05      | 3.00E-01           | 9E-05 | 4.14E-09            | 4.6E-06      | NA                              | --    |

**Panel B. RME Scenario**

**Ingestion of Grouse**

| Chemical of Potential Concern * | Ctissue (mg/kg, wet weight) |     | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|-----------------------------|-----|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |                             |     |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | --                          | [a] | 1.0            | 1.37E-04          | --           | 4.00E-04           | --    | 3.91E-05            | --           | NA                              | --    |
| Arsenic                         | --                          | [a] | 1.0            | 1.37E-04          | --           | 3.00E-04           | --    | 3.91E-05            | --           | 1.50E+00                        | --    |
| Cadmium                         | 2.31E-02                    | [b] | 1.0            | 1.37E-04          | 3.2E-06      | 1.00E-03           | 3E-03 | 3.91E-05            | 9.0E-07      | NA                              | --    |
| Chromium(III)                   | 8.03E-01                    |     | 1.0            | 1.37E-04          | 1.1E-04      | 1.50E+00           | 7E-05 | 3.91E-05            | 3.1E-05      | NA                              | --    |
| Chromium(VI)                    | 8.92E-02                    |     | 1.0            | 1.37E-04          | 1.2E-05      | 3.00E-03           | 4E-03 | 3.91E-05            | 3.5E-06      | 5.00E-01                        | 3E-06 |
| Cobalt                          | --                          | [a] | 1.0            | 1.37E-04          | --           | 3.00E-04           | --    | 3.91E-05            | --           | NA                              | --    |
| Iron                            | --                          | [a] | 1.0            | 1.37E-04          | --           | 7.00E-01           | --    | 3.91E-05            | --           | NA                              | --    |
| Manganese                       | --                          | [a] | 1.0            | 1.37E-04          | --           | 1.40E-01           | --    | 3.91E-05            | --           | NA                              | --    |
| Mercury                         | --                          | [a] | 1.0            | 1.37E-04          | --           | 3.00E-04           | --    | 3.91E-05            | --           | NA                              | --    |
| Thallium                        | --                          | [a] | 1.0            | 1.37E-04          | --           | 1.00E-05           | --    | 3.91E-05            | --           | NA                              | --    |
| Zinc                            | 4.92E+00                    | [c] | 1.0            | 1.37E-04          | 6.7E-04      | 3.00E-01           | 2E-03 | 3.91E-05            | 1.9E-04      | NA                              | --    |

**TABLE D-11a**  
**DETAILED RISK CALCULATIONS FOR THE HUNTER IN EU1**  
*Bonita Peak Mining District*

**Ingestion of Deer**

| Chemical of Potential Concern * | Ctissue (mg/kg, wet weight) |     | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|-----------------------------|-----|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |                             |     |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | --                          | [a] | 1.0            | 1.10E-03          | --           | 4.00E-04           | --    | 3.13E-04            | --           | NA                              | --    |
| Arsenic                         | --                          | [a] | 1.0            | 1.10E-03          | --           | 3.00E-04           | --    | 3.13E-04            | --           | 1.50E+00                        | --    |
| Cadmium                         | --                          | [a] | 1.0            | 1.10E-03          | --           | 1.00E-03           | --    | 3.13E-04            | --           | NA                              | --    |
| Chromium(III)                   | 6.98E-01                    |     | 1.0            | 1.10E-03          | 7.7E-04      | 1.50E+00           | 5E-04 | 3.13E-04            | 2.2E-04      | NA                              | --    |
| Chromium(VI)                    | 7.76E-02                    |     | 1.0            | 1.10E-03          | 8.5E-05      | 3.00E-03           | 3E-02 | 3.13E-04            | 2.4E-05      | 5.00E-01                        | 2E-05 |
| Cobalt                          | --                          | [a] | 1.0            | 1.10E-03          | --           | 3.00E-04           | --    | 3.13E-04            | --           | NA                              | --    |
| Iron                            | 2.95E+01                    |     | 1.0            | 1.10E-03          | 3.2E-02      | 7.00E-01           | 5E-02 | 3.13E-04            | 9.2E-03      | NA                              | --    |
| Manganese                       | 3.45E-01                    | [b] | 1.0            | 1.10E-03          | 3.8E-04      | 1.40E-01           | 3E-03 | 3.13E-04            | 1.1E-04      | NA                              | --    |
| Mercury                         | --                          | [a] | 1.0            | 1.10E-03          | --           | 3.00E-04           | --    | 3.13E-04            | --           | NA                              | --    |
| Thallium                        | --                          | [a] | 1.0            | 1.10E-03          | --           | 1.00E-05           | --    | 3.13E-04            | --           | NA                              | --    |
| Zinc                            | 4.08E+01                    |     | 1.0            | 1.10E-03          | 4.5E-02      | 3.00E-01           | 1E-01 | 3.13E-04            | 1.3E-02      | NA                              | --    |

**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) |  | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|---------------|--|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |               |  |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | 2.85E+00      |  | 1.0            | 9.65E-08          | 2.7E-07      | 4.00E-04           | 7E-04 | 2.76E-08            | 7.8E-08      | NA                              | --    |
| Arsenic                         | 4.28E+01      |  | **             | 9.65E-08          | 4.1E-06      | 3.00E-04           | 1E-02 | 2.76E-08            | 1.2E-06      | 1.50E+00                        | 2E-06 |
| Cadmium                         | 1.42E+01      |  | 1.0            | 9.65E-08          | 1.4E-06      | 1.00E-03           | 1E-03 | 2.76E-08            | 3.9E-07      | NA                              | --    |
| Chromium(III)                   | 2.65E+00      |  | 1.0            | 9.65E-08          | 2.6E-07      | 1.50E+00           | 2E-07 | 2.76E-08            | 7.3E-08      | NA                              | --    |
| Chromium(VI)                    | 2.95E-01      |  | 1.0            | 9.65E-08          | 2.8E-08      | 3.00E-03           | 9E-06 | 2.76E-08            | 8.1E-09      | 5.00E-01                        | 8E-09 |
| Cobalt                          | 9.79E+00      |  | 1.0            | 9.65E-08          | 9.4E-07      | 3.00E-04           | 3E-03 | 2.76E-08            | 2.7E-07      | NA                              | --    |
| Iron                            | 2.02E+04      |  | 1.0            | 9.65E-08          | 2.0E-03      | 7.00E-01           | 3E-03 | 2.76E-08            | 5.6E-04      | NA                              | --    |
| Manganese                       | 5.89E+03      |  | 1.0            | 9.65E-08          | 5.7E-04      | 2.40E-02           | 2E-02 | 2.76E-08            | 1.6E-04      | NA                              | --    |
| Thallium                        | 3.68E-01      |  | 1.0            | 9.65E-08          | 3.6E-08      | 1.00E-05           | 4E-03 | 2.76E-08            | 1.0E-08      | NA                              | --    |
| Zinc                            | 1.12E+03      |  | 1.0            | 9.65E-08          | 1.1E-04      | 3.00E-01           | 4E-04 | 2.76E-08            | 3.1E-05      | NA                              | --    |

\*The EPC values for chromium were assumed to be 10% hexavalent chromium and 90% trivalent chromium.

\*\*The EPC value for arsenic represents the time-weighted concentration, adjusted for the soil-specific RBA for waste rock (0.06) and overbank (0.60)

Ctissue = game tissue concentration    DI = dietary intake    mg = milligram    RME = reasonable maximum exposure  
Csoil = soil concentration    HIF = human intake factor    NC = non-cancer    SF = slope factor  
CTE = cental tendency exposure    HQ = hazard quotient    RBA = relative bioavailability    NA = not available  
d = day    kg = kilogram    RfD = reference dose    -- = not calculated

**TABLE D-12a**  
**DETAILED RISK CALCULATIONS FOR THE HUNTER IN EU2**  
*Bonita Peak Mining District*

**Panel A. CTE Scenario**  
**Ingestion of Grouse**

| Chemical of Potential Concern * | Ctissue (mg/kg, wet weight) |     | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|-----------------------------|-----|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |                             |     |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | --                          | [a] | 1.0            | 3.42E-05          | --           | 4.00E-04           | --    | 5.87E-06            | --           | NA                              | --    |
| Arsenic                         | --                          | [a] | 1.0            | 3.42E-05          | --           | 3.00E-04           | --    | 5.87E-06            | --           | 1.50E+00                        | --    |
| Cadmium                         | 2.31E-02                    | [b] | 1.0            | 3.42E-05          | 7.9E-07      | 1.00E-03           | 8E-04 | 5.87E-06            | 1.4E-07      | NA                              | --    |
| Chromium(III)                   | 8.03E-01                    |     | 1.0            | 3.42E-05          | 2.7E-05      | 1.50E+00           | 2E-05 | 5.87E-06            | 4.7E-06      | NA                              | --    |
| Chromium(VI)                    | 8.92E-02                    |     | 1.0            | 3.42E-05          | 3.1E-06      | 3.00E-03           | 1E-03 | 5.87E-06            | 5.2E-07      | 5.00E-01                        | 5E-07 |
| Cobalt                          | --                          | [a] | 1.0            | 3.42E-05          | --           | 3.00E-04           | --    | 5.87E-06            | --           | NA                              | --    |
| Iron                            | --                          | [a] | 1.0            | 3.42E-05          | --           | 7.00E-01           | --    | 5.87E-06            | --           | NA                              | --    |
| Manganese                       | --                          | [a] | 1.0            | 3.42E-05          | --           | 1.40E-01           | --    | 5.87E-06            | --           | NA                              | --    |
| Mercury                         | --                          | [a] | 1.0            | 3.42E-05          | --           | 3.00E-04           | --    | 5.87E-06            | --           | NA                              | --    |
| Thallium                        | --                          | [a] | 1.0            | 3.42E-05          | --           | 1.00E-05           | --    | 5.87E-06            | --           | NA                              | --    |
| Zinc                            | 4.92E+00                    | [c] | 1.0            | 3.42E-05          | 1.7E-04      | 3.00E-01           | 6E-04 | 5.87E-06            | 2.9E-05      | NA                              | --    |

**Ingestion of Deer**

| Chemical of Potential Concern * | Ctissue (mg/kg, wet weight) |     | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|-----------------------------|-----|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |                             |     |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | --                          | [a] | 1.0            | 2.74E-04          | --           | 4.00E-04           | --    | 4.69E-05            | --           | NA                              | --    |
| Arsenic                         | --                          | [a] | 1.0            | 2.74E-04          | --           | 3.00E-04           | --    | 4.69E-05            | --           | 1.50E+00                        | --    |
| Cadmium                         | --                          | [a] | 1.0            | 2.74E-04          | --           | 1.00E-03           | --    | 4.69E-05            | --           | NA                              | --    |
| Chromium(III)                   | 6.98E-01                    |     | 1.0            | 2.74E-04          | 1.9E-04      | 1.50E+00           | 1E-04 | 4.69E-05            | 3.3E-05      | NA                              | --    |
| Chromium(VI)                    | 7.76E-02                    |     | 1.0            | 2.74E-04          | 2.1E-05      | 3.00E-03           | 7E-03 | 4.69E-05            | 3.6E-06      | 5.00E-01                        | 4E-06 |
| Cobalt                          | --                          | [a] | 1.0            | 2.74E-04          | --           | 3.00E-04           | --    | 4.69E-05            | --           | NA                              | --    |
| Iron                            | 2.95E+01                    |     | 1.0            | 2.74E-04          | 8.1E-03      | 7.00E-01           | 1E-02 | 4.69E-05            | 1.4E-03      | NA                              | --    |
| Manganese                       | 3.45E-01                    | [b] | 1.0            | 2.74E-04          | 9.4E-05      | 1.40E-01           | 7E-04 | 4.69E-05            | 1.6E-05      | NA                              | --    |
| Mercury                         | --                          | [a] | 1.0            | 2.74E-04          | --           | 3.00E-04           | --    | 4.69E-05            | --           | NA                              | --    |
| Thallium                        | --                          | [a] | 1.0            | 2.74E-04          | --           | 1.00E-05           | --    | 4.69E-05            | --           | NA                              | --    |
| Zinc                            | 4.08E+01                    |     | 1.0            | 2.74E-04          | 1.1E-02      | 3.00E-01           | 4E-02 | 4.69E-05            | 1.9E-03      | NA                              | --    |

**TABLE D-12a**  
**DETAILED RISK CALCULATIONS FOR THE HUNTER IN EU2**  
*Bonita Peak Mining District*

**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) |  | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|---------------|--|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |               |  |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | 1.49E+01      |  | 1.0            | 2.41E-08          | 3.6E-07      | 4.00E-04           | 9E-04 | 4.14E-09            | 6.1E-08      | NA                              | --    |
| Arsenic                         | 2.20E+01      |  | **             | 2.41E-08          | 5.3E-07      | 3.00E-04           | 2E-03 | 4.14E-09            | 9.1E-08      | 1.50E+00                        | 1E-07 |
| Cadmium                         | 4.90E+00      |  | 1.0            | 2.41E-08          | 1.2E-07      | 1.00E-03           | 1E-04 | 4.14E-09            | 2.0E-08      | NA                              | --    |
| Chromium(III)                   | 2.84E+00      |  | 1.0            | 2.41E-08          | 6.9E-08      | 1.50E+00           | 5E-08 | 4.14E-09            | 1.2E-08      | NA                              | --    |
| Chromium(VI)                    | 3.16E-01      |  | 1.0            | 2.41E-08          | 7.6E-09      | 3.00E-03           | 3E-06 | 4.14E-09            | 1.3E-09      | 5.00E-01                        | 1E-09 |
| Cobalt                          | 7.17E+00      |  | 1.0            | 2.41E-08          | 1.7E-07      | 3.00E-04           | 6E-04 | 4.14E-09            | 3.0E-08      | NA                              | --    |
| Iron                            | 2.21E+04      |  | 1.0            | 2.41E-08          | 5.3E-04      | 7.00E-01           | 8E-04 | 4.14E-09            | 9.1E-05      | NA                              | --    |
| Manganese                       | 6.52E+03      |  | 1.0            | 2.41E-08          | 1.6E-04      | 2.40E-02           | 7E-03 | 4.14E-09            | 2.7E-05      | NA                              | --    |
| Thallium                        | 2.33E-01      |  | 1.0            | 2.41E-08          | 5.6E-09      | 1.00E-05           | 6E-04 | 4.14E-09            | 9.6E-10      | NA                              | --    |
| Zinc                            | 1.35E+03      |  | 1.0            | 2.41E-08          | 3.3E-05      | 3.00E-01           | 1E-04 | 4.14E-09            | 5.6E-06      | NA                              | --    |

**Panel B. RME Scenario**

**Ingestion of Grouse**

| Chemical of Potential Concern * | Ctissue (mg/kg, wet weight) |     | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|-----------------------------|-----|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |                             |     |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | --                          | [a] | 1.0            | 1.37E-04          | --           | 4.00E-04           | --    | 3.91E-05            | --           | NA                              | --    |
| Arsenic                         | --                          | [a] | 1.0            | 1.37E-04          | --           | 3.00E-04           | --    | 3.91E-05            | --           | 1.50E+00                        | --    |
| Cadmium                         | 2.31E-02                    | [b] | 1.0            | 1.37E-04          | 3.2E-06      | 1.00E-03           | 3E-03 | 3.91E-05            | 9.0E-07      | NA                              | --    |
| Chromium(III)                   | 8.03E-01                    |     | 1.0            | 1.37E-04          | 1.1E-04      | 1.50E+00           | 7E-05 | 3.91E-05            | 3.1E-05      | NA                              | --    |
| Chromium(VI)                    | 8.92E-02                    |     | 1.0            | 1.37E-04          | 1.2E-05      | 3.00E-03           | 4E-03 | 3.91E-05            | 3.5E-06      | 5.00E-01                        | 3E-06 |
| Cobalt                          | --                          | [a] | 1.0            | 1.37E-04          | --           | 3.00E-04           | --    | 3.91E-05            | --           | NA                              | --    |
| Iron                            | --                          | [a] | 1.0            | 1.37E-04          | --           | 7.00E-01           | --    | 3.91E-05            | --           | NA                              | --    |
| Manganese                       | --                          | [a] | 1.0            | 1.37E-04          | --           | 1.40E-01           | --    | 3.91E-05            | --           | NA                              | --    |
| Mercury                         | --                          | [a] | 1.0            | 1.37E-04          | --           | 3.00E-04           | --    | 3.91E-05            | --           | NA                              | --    |
| Thallium                        | --                          | [a] | 1.0            | 1.37E-04          | --           | 1.00E-05           | --    | 3.91E-05            | --           | NA                              | --    |
| Zinc                            | 4.92E+00                    | [c] | 1.0            | 1.37E-04          | 6.7E-04      | 3.00E-01           | 2E-03 | 3.91E-05            | 1.9E-04      | NA                              | --    |

**TABLE D-12a**  
**DETAILED RISK CALCULATIONS FOR THE HUNTER IN EU2**  
*Bonita Peak Mining District*

**Ingestion of Deer**

| Chemical of Potential Concern * | Ctissue (mg/kg, wet weight) |     | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|-----------------------------|-----|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |                             |     |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | --                          | [a] | 1.0            | 1.10E-03          | --           | 4.00E-04           | --    | 3.13E-04            | --           | NA                              | --    |
| Arsenic                         | --                          | [a] | 1.0            | 1.10E-03          | --           | 3.00E-04           | --    | 3.13E-04            | --           | 1.50E+00                        | --    |
| Cadmium                         | --                          | [a] | 1.0            | 1.10E-03          | --           | 1.00E-03           | --    | 3.13E-04            | --           | NA                              | --    |
| Chromium(III)                   | 6.98E-01                    |     | 1.0            | 1.10E-03          | 7.7E-04      | 1.50E+00           | 5E-04 | 3.13E-04            | 2.2E-04      | NA                              | --    |
| Chromium(VI)                    | 7.76E-02                    |     | 1.0            | 1.10E-03          | 8.5E-05      | 3.00E-03           | 3E-02 | 3.13E-04            | 2.4E-05      | 5.00E-01                        | 2E-05 |
| Cobalt                          | --                          | [a] | 1.0            | 1.10E-03          | --           | 3.00E-04           | --    | 3.13E-04            | --           | NA                              | --    |
| Iron                            | 2.95E+01                    |     | 1.0            | 1.10E-03          | 3.2E-02      | 7.00E-01           | 5E-02 | 3.13E-04            | 9.2E-03      | NA                              | --    |
| Manganese                       | 3.45E-01                    | [b] | 1.0            | 1.10E-03          | 3.8E-04      | 1.40E-01           | 3E-03 | 3.13E-04            | 1.1E-04      | NA                              | --    |
| Mercury                         | --                          | [a] | 1.0            | 1.10E-03          | --           | 3.00E-04           | --    | 3.13E-04            | --           | NA                              | --    |
| Thallium                        | --                          | [a] | 1.0            | 1.10E-03          | --           | 1.00E-05           | --    | 3.13E-04            | --           | NA                              | --    |
| Zinc                            | 4.08E+01                    |     | 1.0            | 1.10E-03          | 4.5E-02      | 3.00E-01           | 1E-01 | 3.13E-04            | 1.3E-02      | NA                              | --    |

**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) |  | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|---------------|--|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |               |  |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | 1.49E+01      |  | 1.0            | 9.65E-08          | 1.4E-06      | 4.00E-04           | 4E-03 | 2.76E-08            | 4.1E-07      | NA                              | --    |
| Arsenic                         | 2.20E+01      |  | **             | 9.65E-08          | 2.1E-06      | 3.00E-04           | 7E-03 | 2.76E-08            | 6.1E-07      | 1.50E+00                        | 9E-07 |
| Cadmium                         | 4.90E+00      |  | 1.0            | 9.65E-08          | 4.7E-07      | 1.00E-03           | 5E-04 | 2.76E-08            | 1.4E-07      | NA                              | --    |
| Chromium(III)                   | 2.84E+00      |  | 1.0            | 9.65E-08          | 2.7E-07      | 1.50E+00           | 2E-07 | 2.76E-08            | 7.8E-08      | NA                              | --    |
| Chromium(VI)                    | 3.16E-01      |  | 1.0            | 9.65E-08          | 3.0E-08      | 3.00E-03           | 1E-05 | 2.76E-08            | 8.7E-09      | 5.00E-01                        | 9E-09 |
| Cobalt                          | 7.17E+00      |  | 1.0            | 9.65E-08          | 6.9E-07      | 3.00E-04           | 2E-03 | 2.76E-08            | 2.0E-07      | NA                              | --    |
| Iron                            | 2.21E+04      |  | 1.0            | 9.65E-08          | 2.1E-03      | 7.00E-01           | 3E-03 | 2.76E-08            | 6.1E-04      | NA                              | --    |
| Manganese                       | 6.52E+03      |  | 1.0            | 9.65E-08          | 6.3E-04      | 2.40E-02           | 3E-02 | 2.76E-08            | 1.8E-04      | NA                              | --    |
| Thallium                        | 2.33E-01      |  | 1.0            | 9.65E-08          | 2.2E-08      | 1.00E-05           | 2E-03 | 2.76E-08            | 6.4E-09      | NA                              | --    |
| Zinc                            | 1.35E+03      |  | 1.0            | 9.65E-08          | 1.3E-04      | 3.00E-01           | 4E-04 | 2.76E-08            | 3.7E-05      | NA                              | --    |

\*The EPC values for chromium were assumed to be 10% hexavalent chromium and 90% trivalent chromium.

\*\*The EPC value for arsenic represents the time-weighted concentration, adjusted for the soil-specific RBA for waste rock (0.06) and overbank (0.60)

Ctissue = game tissue concentration      DI = dietary intake      mg = milligram      RME = reasonable maximum exposure  
Csoil = soil concentration                  HIF = human intake factor      NC = non-cancer      SF = slope factor  
CTE = cental tendency exposure          HQ = hazard quotient          RBA = relative bioavailblty      NA = not available  
d = day                                              kg = kilogram                      RfD = reference dose              -- = not calculated

**TABLE D-13a**  
**DETAILED RISK CALCULATIONS FOR THE HUNTER IN EU3**  
*Bonita Peak Mining District*

**Panel A. CTE Scenario**  
**Ingestion of Grouse**

| Chemical of Potential Concern * | Ctissue (mg/kg, wet weight) |     | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|-----------------------------|-----|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |                             |     |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | --                          | [a] | 1.0            | 3.42E-05          | --           | 4.00E-04           | --    | 5.87E-06            | --           | NA                              | --    |
| Arsenic                         | --                          | [a] | 1.0            | 3.42E-05          | --           | 3.00E-04           | --    | 5.87E-06            | --           | 1.50E+00                        | --    |
| Cadmium                         | 2.31E-02                    | [b] | 1.0            | 3.42E-05          | 7.9E-07      | 1.00E-03           | 8E-04 | 5.87E-06            | 1.4E-07      | NA                              | --    |
| Chromium(III)                   | 8.03E-01                    |     | 1.0            | 3.42E-05          | 2.7E-05      | 1.50E+00           | 2E-05 | 5.87E-06            | 4.7E-06      | NA                              | --    |
| Chromium(VI)                    | 8.92E-02                    |     | 1.0            | 3.42E-05          | 3.1E-06      | 3.00E-03           | 1E-03 | 5.87E-06            | 5.2E-07      | 5.00E-01                        | 5E-07 |
| Cobalt                          | --                          | [a] | 1.0            | 3.42E-05          | --           | 3.00E-04           | --    | 5.87E-06            | --           | NA                              | --    |
| Iron                            | --                          | [a] | 1.0            | 3.42E-05          | --           | 7.00E-01           | --    | 5.87E-06            | --           | NA                              | --    |
| Manganese                       | --                          | [a] | 1.0            | 3.42E-05          | --           | 1.40E-01           | --    | 5.87E-06            | --           | NA                              | --    |
| Mercury                         | --                          | [a] | 1.0            | 3.42E-05          | --           | 3.00E-04           | --    | 5.87E-06            | --           | NA                              | --    |
| Thallium                        | --                          | [a] | 1.0            | 3.42E-05          | --           | 1.00E-05           | --    | 5.87E-06            | --           | NA                              | --    |
| Zinc                            | 4.92E+00                    | [c] | 1.0            | 3.42E-05          | 1.7E-04      | 3.00E-01           | 6E-04 | 5.87E-06            | 2.9E-05      | NA                              | --    |

**Ingestion of Deer**

| Chemical of Potential Concern * | Ctissue (mg/kg, wet weight) |     | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|-----------------------------|-----|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |                             |     |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | --                          | [a] | 1.0            | 2.74E-04          | --           | 4.00E-04           | --    | 4.69E-05            | --           | NA                              | --    |
| Arsenic                         | --                          | [a] | 1.0            | 2.74E-04          | --           | 3.00E-04           | --    | 4.69E-05            | --           | 1.50E+00                        | --    |
| Cadmium                         | --                          | [a] | 1.0            | 2.74E-04          | --           | 1.00E-03           | --    | 4.69E-05            | --           | NA                              | --    |
| Chromium(III)                   | 6.98E-01                    |     | 1.0            | 2.74E-04          | 1.9E-04      | 1.50E+00           | 1E-04 | 4.69E-05            | 3.3E-05      | NA                              | --    |
| Chromium(VI)                    | 7.76E-02                    |     | 1.0            | 2.74E-04          | 2.1E-05      | 3.00E-03           | 7E-03 | 4.69E-05            | 3.6E-06      | 5.00E-01                        | 4E-06 |
| Cobalt                          | --                          | [a] | 1.0            | 2.74E-04          | --           | 3.00E-04           | --    | 4.69E-05            | --           | NA                              | --    |
| Iron                            | 2.95E+01                    |     | 1.0            | 2.74E-04          | 8.1E-03      | 7.00E-01           | 1E-02 | 4.69E-05            | 1.4E-03      | NA                              | --    |
| Manganese                       | 3.45E-01                    | [b] | 1.0            | 2.74E-04          | 9.4E-05      | 1.40E-01           | 7E-04 | 4.69E-05            | 1.6E-05      | NA                              | --    |
| Mercury                         | --                          | [a] | 1.0            | 2.74E-04          | --           | 3.00E-04           | --    | 4.69E-05            | --           | NA                              | --    |
| Thallium                        | --                          | [a] | 1.0            | 2.74E-04          | --           | 1.00E-05           | --    | 4.69E-05            | --           | NA                              | --    |
| Zinc                            | 4.08E+01                    |     | 1.0            | 2.74E-04          | 1.1E-02      | 3.00E-01           | 4E-02 | 4.69E-05            | 1.9E-03      | NA                              | --    |

**TABLE D-13a**  
**DETAILED RISK CALCULATIONS FOR THE HUNTER IN EU3**  
*Bonita Peak Mining District*

**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) |  | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|---------------|--|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |               |  |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | 1.76E+00      |  | 1.0            | 2.41E-08          | 4.2E-08      | 4.00E-04           | 1E-04 | 4.14E-09            | 7.3E-09      | NA                              | --    |
| Arsenic                         | 2.30E+01      |  | **             | 2.41E-08          | 5.6E-07      | 3.00E-04           | 2E-03 | 4.14E-09            | 9.5E-08      | 1.50E+00                        | 1E-07 |
| Cadmium                         | 4.02E+00      |  | 1.0            | 2.41E-08          | 9.7E-08      | 1.00E-03           | 1E-04 | 4.14E-09            | 1.7E-08      | NA                              | --    |
| Chromium(III)                   | 2.73E+00      |  | 1.0            | 2.41E-08          | 6.6E-08      | 1.50E+00           | 4E-08 | 4.14E-09            | 1.1E-08      | NA                              | --    |
| Chromium(VI)                    | 3.03E-01      |  | 1.0            | 2.41E-08          | 7.3E-09      | 3.00E-03           | 2E-06 | 4.14E-09            | 1.3E-09      | 5.00E-01                        | 1E-09 |
| Cobalt                          | 4.96E+00      |  | 1.0            | 2.41E-08          | 1.2E-07      | 3.00E-04           | 4E-04 | 4.14E-09            | 2.1E-08      | NA                              | --    |
| Iron                            | 3.03E+04      |  | 1.0            | 2.41E-08          | 7.3E-04      | 7.00E-01           | 1E-03 | 4.14E-09            | 1.3E-04      | NA                              | --    |
| Manganese                       | 1.54E+03      |  | 1.0            | 2.41E-08          | 3.7E-05      | 2.40E-02           | 2E-03 | 4.14E-09            | 6.4E-06      | NA                              | --    |
| Thallium                        | 5.43E-01      |  | 1.0            | 2.41E-08          | 1.3E-08      | 1.00E-05           | 1E-03 | 4.14E-09            | 2.2E-09      | NA                              | --    |
| Zinc                            | 6.69E+02      |  | 1.0            | 2.41E-08          | 1.6E-05      | 3.00E-01           | 5E-05 | 4.14E-09            | 2.8E-06      | NA                              | --    |

**Panel B. RME Scenario**

**Ingestion of Grouse**

| Chemical of Potential Concern * | Ctissue (mg/kg, wet weight) |     | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|-----------------------------|-----|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |                             |     |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | --                          | [a] | 1.0            | 1.37E-04          | --           | 4.00E-04           | --    | 3.91E-05            | --           | NA                              | --    |
| Arsenic                         | --                          | [a] | 1.0            | 1.37E-04          | --           | 3.00E-04           | --    | 3.91E-05            | --           | 1.50E+00                        | --    |
| Cadmium                         | 2.31E-02                    | [b] | 1.0            | 1.37E-04          | 3.2E-06      | 1.00E-03           | 3E-03 | 3.91E-05            | 9.0E-07      | NA                              | --    |
| Chromium(III)                   | 8.03E-01                    |     | 1.0            | 1.37E-04          | 1.1E-04      | 1.50E+00           | 7E-05 | 3.91E-05            | 3.1E-05      | NA                              | --    |
| Chromium(VI)                    | 8.92E-02                    |     | 1.0            | 1.37E-04          | 1.2E-05      | 3.00E-03           | 4E-03 | 3.91E-05            | 3.5E-06      | 5.00E-01                        | 3E-06 |
| Cobalt                          | --                          | [a] | 1.0            | 1.37E-04          | --           | 3.00E-04           | --    | 3.91E-05            | --           | NA                              | --    |
| Iron                            | --                          | [a] | 1.0            | 1.37E-04          | --           | 7.00E-01           | --    | 3.91E-05            | --           | NA                              | --    |
| Manganese                       | --                          | [a] | 1.0            | 1.37E-04          | --           | 1.40E-01           | --    | 3.91E-05            | --           | NA                              | --    |
| Mercury                         | --                          | [a] | 1.0            | 1.37E-04          | --           | 3.00E-04           | --    | 3.91E-05            | --           | NA                              | --    |
| Thallium                        | --                          | [a] | 1.0            | 1.37E-04          | --           | 1.00E-05           | --    | 3.91E-05            | --           | NA                              | --    |
| Zinc                            | 4.92E+00                    | [c] | 1.0            | 1.37E-04          | 6.7E-04      | 3.00E-01           | 2E-03 | 3.91E-05            | 1.9E-04      | NA                              | --    |

**TABLE D-13a**  
**DETAILED RISK CALCULATIONS FOR THE HUNTER IN EU3**  
*Bonita Peak Mining District*

**Ingestion of Deer**

| Chemical of Potential Concern | Ctissue (mg/kg, wet weight) |     | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|-------------------------------|-----------------------------|-----|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                               |                             |     |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                      | --                          | [a] | 1.0            | 1.10E-03          | --           | 4.00E-04           | --    | 3.13E-04            | --           | NA                              | --    |
| Arsenic                       | --                          | [a] | 1.0            | 1.10E-03          | --           | 3.00E-04           | --    | 3.13E-04            | --           | 1.50E+00                        | --    |
| Cadmium                       | --                          | [a] | 1.0            | 1.10E-03          | --           | 1.00E-03           | --    | 3.13E-04            | --           | NA                              | --    |
| Chromium(III)                 | 6.98E-01                    |     | 1.0            | 1.10E-03          | 7.7E-04      | 1.50E+00           | 5E-04 | 3.13E-04            | 2.2E-04      | NA                              | --    |
| Chromium(VI)                  | 7.76E-02                    |     | 1.0            | 1.10E-03          | 8.5E-05      | 3.00E-03           | 3E-02 | 3.13E-04            | 2.4E-05      | 5.00E-01                        | 2E-05 |
| Cobalt                        | --                          | [a] | 1.0            | 1.10E-03          | --           | 3.00E-04           | --    | 3.13E-04            | --           | NA                              | --    |
| Iron                          | 2.95E+01                    |     | 1.0            | 1.10E-03          | 3.2E-02      | 7.00E-01           | 5E-02 | 3.13E-04            | 9.2E-03      | NA                              | --    |
| Manganese                     | 3.45E-01                    | [b] | 1.0            | 1.10E-03          | 3.8E-04      | 1.40E-01           | 3E-03 | 3.13E-04            | 1.1E-04      | NA                              | --    |
| Mercury                       | --                          | [a] | 1.0            | 1.10E-03          | --           | 3.00E-04           | --    | 3.13E-04            | --           | NA                              | --    |
| Thallium                      | --                          | [a] | 1.0            | 1.10E-03          | --           | 1.00E-05           | --    | 3.13E-04            | --           | NA                              | --    |
| Zinc                          | 4.08E+01                    |     | 1.0            | 1.10E-03          | 4.5E-02      | 3.00E-01           | 1E-01 | 3.13E-04            | 1.3E-02      | NA                              | --    |

**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) |  | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|---------------|--|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |               |  |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | 1.76E+00      |  | 1.0            | 9.65E-08          | 1.7E-07      | 4.00E-04           | 4E-04 | 2.76E-08            | 4.9E-08      | NA                              | --    |
| Arsenic                         | 2.30E+01      |  | **             | 9.65E-08          | 2.2E-06      | 3.00E-04           | 7E-03 | 2.76E-08            | 6.3E-07      | 1.50E+00                        | 1E-06 |
| Cadmium                         | 4.02E+00      |  | 1.0            | 9.65E-08          | 3.9E-07      | 1.00E-03           | 4E-04 | 2.76E-08            | 1.1E-07      | NA                              | --    |
| Chromium(III)                   | 2.73E+00      |  | 1.0            | 9.65E-08          | 2.6E-07      | 1.50E+00           | 2E-07 | 2.76E-08            | 7.5E-08      | NA                              | --    |
| Chromium(VI)                    | 3.03E-01      |  | 1.0            | 9.65E-08          | 2.9E-08      | 3.00E-03           | 1E-05 | 2.76E-08            | 8.4E-09      | 5.00E-01                        | 8E-09 |
| Cobalt                          | 4.96E+00      |  | 1.0            | 9.65E-08          | 4.8E-07      | 3.00E-04           | 2E-03 | 2.76E-08            | 1.4E-07      | NA                              | --    |
| Iron                            | 3.03E+04      |  | 1.0            | 9.65E-08          | 2.9E-03      | 7.00E-01           | 4E-03 | 2.76E-08            | 8.4E-04      | NA                              | --    |
| Manganese                       | 1.54E+03      |  | 1.0            | 9.65E-08          | 1.5E-04      | 2.40E-02           | 6E-03 | 2.76E-08            | 4.2E-05      | NA                              | --    |
| Thallium                        | 5.43E-01      |  | 1.0            | 9.65E-08          | 5.2E-08      | 1.00E-05           | 5E-03 | 2.76E-08            | 1.5E-08      | NA                              | --    |
| Zinc                            | 6.69E+02      |  | 1.0            | 9.65E-08          | 6.5E-05      | 3.00E-01           | 2E-04 | 2.76E-08            | 1.8E-05      | NA                              | --    |

\*The EPC values for chromium were assumed to be 10% hexavalent chromium and 90% trivalent chromium.

\*\*The EPC value for arsenic represents the time-weighted concentration, adjusted for the soil-specific RBA for waste rock (0.06) and overbank (0.60)

Ctissue = game tissue concentration      DI = dietary intake      mg = milligram      RME = reasonable maximum exposure  
Csoil = soil concentration                  HIF = human intake factor      NC = non-cancer      SF = slope factor  
CTE = cental tendency exposure          HQ = hazard quotient          RBA = relative bioavailblty      NA = not available  
d = day                                              kg = kilogram                  RfD = reference dose              -- = not calculated

**TABLE D-14a**  
**DETAILED RISK CALCULATIONS FOR THE HUNTER IN EU4**  
*Bonita Peak Mining District*

**Panel A. CTE Scenario**  
**Ingestion of Grouse**

| Chemical of Potential Concern * | Ctissue (mg/kg, wet weight) |     | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|-----------------------------|-----|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |                             |     |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | --                          | [a] | 1.0            | 3.42E-05          | --           | 4.00E-04           | --    | 5.87E-06            | --           | NA                              | --    |
| Arsenic                         | --                          | [a] | 1.0            | 3.42E-05          | --           | 3.00E-04           | --    | 5.87E-06            | --           | 1.50E+00                        | --    |
| Cadmium                         | 2.31E-02                    | [b] | 1.0            | 3.42E-05          | 7.9E-07      | 1.00E-03           | 8E-04 | 5.87E-06            | 1.4E-07      | NA                              | --    |
| Chromium(III)                   | 8.03E-01                    |     | 1.0            | 3.42E-05          | 2.7E-05      | 1.50E+00           | 2E-05 | 5.87E-06            | 4.7E-06      | NA                              | --    |
| Chromium(VI)                    | 8.92E-02                    |     | 1.0            | 3.42E-05          | 3.1E-06      | 3.00E-03           | 1E-03 | 5.87E-06            | 5.2E-07      | 5.00E-01                        | 5E-07 |
| Cobalt                          | --                          | [a] | 1.0            | 3.42E-05          | --           | 3.00E-04           | --    | 5.87E-06            | --           | NA                              | --    |
| Iron                            | --                          | [a] | 1.0            | 3.42E-05          | --           | 7.00E-01           | --    | 5.87E-06            | --           | NA                              | --    |
| Manganese                       | --                          | [a] | 1.0            | 3.42E-05          | --           | 1.40E-01           | --    | 5.87E-06            | --           | NA                              | --    |
| Mercury                         | --                          | [a] | 1.0            | 3.42E-05          | --           | 3.00E-04           | --    | 5.87E-06            | --           | NA                              | --    |
| Thallium                        | --                          | [a] | 1.0            | 3.42E-05          | --           | 1.00E-05           | --    | 5.87E-06            | --           | NA                              | --    |
| Zinc                            | 4.92E+00                    | [c] | 1.0            | 3.42E-05          | 1.7E-04      | 3.00E-01           | 6E-04 | 5.87E-06            | 2.9E-05      | NA                              | --    |

**Ingestion of Deer**

| Chemical of Potential Concern * | Ctissue (mg/kg, wet weight) |     | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|-----------------------------|-----|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |                             |     |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | --                          | [a] | 1.0            | 2.74E-04          | --           | 4.00E-04           | --    | 4.69E-05            | --           | NA                              | --    |
| Arsenic                         | --                          | [a] | 1.0            | 2.74E-04          | --           | 3.00E-04           | --    | 4.69E-05            | --           | 1.50E+00                        | --    |
| Cadmium                         | --                          | [a] | 1.0            | 2.74E-04          | --           | 1.00E-03           | --    | 4.69E-05            | --           | NA                              | --    |
| Chromium(III)                   | 6.98E-01                    |     | 1.0            | 2.74E-04          | 1.9E-04      | 1.50E+00           | 1E-04 | 4.69E-05            | 3.3E-05      | NA                              | --    |
| Chromium(VI)                    | 7.76E-02                    |     | 1.0            | 2.74E-04          | 2.1E-05      | 3.00E-03           | 7E-03 | 4.69E-05            | 3.6E-06      | 5.00E-01                        | 4E-06 |
| Cobalt                          | --                          | [a] | 1.0            | 2.74E-04          | --           | 3.00E-04           | --    | 4.69E-05            | --           | NA                              | --    |
| Iron                            | 2.95E+01                    |     | 1.0            | 2.74E-04          | 8.1E-03      | 7.00E-01           | 1E-02 | 4.69E-05            | 1.4E-03      | NA                              | --    |
| Manganese                       | 3.45E-01                    | [b] | 1.0            | 2.74E-04          | 9.4E-05      | 1.40E-01           | 7E-04 | 4.69E-05            | 1.6E-05      | NA                              | --    |
| Mercury                         | --                          | [a] | 1.0            | 2.74E-04          | --           | 3.00E-04           | --    | 4.69E-05            | --           | NA                              | --    |
| Thallium                        | --                          | [a] | 1.0            | 2.74E-04          | --           | 1.00E-05           | --    | 4.69E-05            | --           | NA                              | --    |
| Zinc                            | 4.08E+01                    |     | 1.0            | 2.74E-04          | 1.1E-02      | 3.00E-01           | 4E-02 | 4.69E-05            | 1.9E-03      | NA                              | --    |

**TABLE D-14a**  
**DETAILED RISK CALCULATIONS FOR THE HUNTER IN EU4**  
*Bonita Peak Mining District*

**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) |  | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|---------------|--|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |               |  |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | 1.83E+00      |  | 1.0            | 2.41E-08          | 4.4E-08      | 4.00E-04           | 1E-04 | 4.14E-09            | 7.6E-09      | NA                              | --    |
| Arsenic                         | 9.27E+01      |  | **             | 2.41E-08          | 2.2E-06      | 3.00E-04           | 7E-03 | 4.14E-09            | 3.8E-07      | 1.50E+00                        | 6E-07 |
| Cadmium                         | 2.60E+00      |  | 1.0            | 2.41E-08          | 6.3E-08      | 1.00E-03           | 6E-05 | 4.14E-09            | 1.1E-08      | NA                              | --    |
| Chromium(III)                   | 2.35E+00      |  | 1.0            | 2.41E-08          | 5.7E-08      | 1.50E+00           | 4E-08 | 4.14E-09            | 9.7E-09      | NA                              | --    |
| Chromium(VI)                    | 2.61E-01      |  | 1.0            | 2.41E-08          | 6.3E-09      | 3.00E-03           | 2E-06 | 4.14E-09            | 1.1E-09      | 5.00E-01                        | 1E-09 |
| Cobalt                          | 8.73E+00      |  | 1.0            | 2.41E-08          | 2.1E-07      | 3.00E-04           | 7E-04 | 4.14E-09            | 3.6E-08      | NA                              | --    |
| Iron                            | 3.39E+04      |  | 1.0            | 2.41E-08          | 8.2E-04      | 7.00E-01           | 1E-03 | 4.14E-09            | 1.4E-04      | NA                              | --    |
| Manganese                       | 1.40E+03      |  | 1.0            | 2.41E-08          | 3.4E-05      | 2.40E-02           | 1E-03 | 4.14E-09            | 5.8E-06      | NA                              | --    |
| Thallium                        | 7.28E-02      |  | 1.0            | 2.41E-08          | 1.8E-09      | 1.00E-05           | 2E-04 | 4.14E-09            | 3.0E-10      | NA                              | --    |
| Zinc                            | 5.59E+02      |  | 1.0            | 2.41E-08          | 1.3E-05      | 3.00E-01           | 4E-05 | 4.14E-09            | 2.3E-06      | NA                              | --    |

**Panel B. RME Scenario**

**Ingestion of Grouse**

| Chemical of Potential Concern * | Ctissue (mg/kg, wet weight) |     | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|-----------------------------|-----|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |                             |     |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | --                          | [a] | 1.0            | 1.37E-04          | --           | 4.00E-04           | --    | 3.91E-05            | --           | NA                              | --    |
| Arsenic                         | --                          | [a] | 1.0            | 1.37E-04          | --           | 3.00E-04           | --    | 3.91E-05            | --           | 1.50E+00                        | --    |
| Cadmium                         | 2.31E-02                    | [b] | 1.0            | 1.37E-04          | 3.2E-06      | 1.00E-03           | 3E-03 | 3.91E-05            | 9.0E-07      | NA                              | --    |
| Chromium(III)                   | 8.03E-01                    |     | 1.0            | 1.37E-04          | 1.1E-04      | 1.50E+00           | 7E-05 | 3.91E-05            | 3.1E-05      | NA                              | --    |
| Chromium(VI)                    | 8.92E-02                    |     | 1.0            | 1.37E-04          | 1.2E-05      | 3.00E-03           | 4E-03 | 3.91E-05            | 3.5E-06      | 5.00E-01                        | 3E-06 |
| Cobalt                          | --                          | [a] | 1.0            | 1.37E-04          | --           | 3.00E-04           | --    | 3.91E-05            | --           | NA                              | --    |
| Iron                            | --                          | [a] | 1.0            | 1.37E-04          | --           | 7.00E-01           | --    | 3.91E-05            | --           | NA                              | --    |
| Manganese                       | --                          | [a] | 1.0            | 1.37E-04          | --           | 1.40E-01           | --    | 3.91E-05            | --           | NA                              | --    |
| Mercury                         | --                          | [a] | 1.0            | 1.37E-04          | --           | 3.00E-04           | --    | 3.91E-05            | --           | NA                              | --    |
| Thallium                        | --                          | [a] | 1.0            | 1.37E-04          | --           | 1.00E-05           | --    | 3.91E-05            | --           | NA                              | --    |
| Zinc                            | 4.92E+00                    | [c] | 1.0            | 1.37E-04          | 6.7E-04      | 3.00E-01           | 2E-03 | 3.91E-05            | 1.9E-04      | NA                              | --    |

**TABLE D-14a**  
**DETAILED RISK CALCULATIONS FOR THE HUNTER IN EU4**  
*Bonita Peak Mining District*

**Ingestion of Deer**

| Chemical of Potential Concern * | Ctissue (mg/kg, wet weight) |     | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|-----------------------------|-----|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |                             |     |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | --                          | [a] | 1.0            | 1.10E-03          | --           | 4.00E-04           | --    | 3.13E-04            | --           | NA                              | --    |
| Arsenic                         | --                          | [a] | 1.0            | 1.10E-03          | --           | 3.00E-04           | --    | 3.13E-04            | --           | 1.50E+00                        | --    |
| Cadmium                         | --                          | [a] | 1.0            | 1.10E-03          | --           | 1.00E-03           | --    | 3.13E-04            | --           | NA                              | --    |
| Chromium(III)                   | 6.98E-01                    |     | 1.0            | 1.10E-03          | 7.7E-04      | 1.50E+00           | 5E-04 | 3.13E-04            | 2.2E-04      | NA                              | --    |
| Chromium(VI)                    | 7.76E-02                    |     | 1.0            | 1.10E-03          | 8.5E-05      | 3.00E-03           | 3E-02 | 3.13E-04            | 2.4E-05      | 5.00E-01                        | 2E-05 |
| Cobalt                          | --                          | [a] | 1.0            | 1.10E-03          | --           | 3.00E-04           | --    | 3.13E-04            | --           | NA                              | --    |
| Iron                            | 2.95E+01                    |     | 1.0            | 1.10E-03          | 3.2E-02      | 7.00E-01           | 5E-02 | 3.13E-04            | 9.2E-03      | NA                              | --    |
| Manganese                       | 3.45E-01                    | [b] | 1.0            | 1.10E-03          | 3.8E-04      | 1.40E-01           | 3E-03 | 3.13E-04            | 1.1E-04      | NA                              | --    |
| Mercury                         | --                          | [a] | 1.0            | 1.10E-03          | --           | 3.00E-04           | --    | 3.13E-04            | --           | NA                              | --    |
| Thallium                        | --                          | [a] | 1.0            | 1.10E-03          | --           | 1.00E-05           | --    | 3.13E-04            | --           | NA                              | --    |
| Zinc                            | 4.08E+01                    |     | 1.0            | 1.10E-03          | 4.5E-02      | 3.00E-01           | 1E-01 | 3.13E-04            | 1.3E-02      | NA                              | --    |

**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) |  | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|---------------|--|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |               |  |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | 1.83E+00      |  | 1.0            | 9.65E-08          | 1.8E-07      | 4.00E-04           | 4E-04 | 2.76E-08            | 5.0E-08      | NA                              | --    |
| Arsenic                         | 9.27E+01      |  | **             | 9.65E-08          | 8.9E-06      | 3.00E-04           | 3E-02 | 2.76E-08            | 2.6E-06      | 1.50E+00                        | 4E-06 |
| Cadmium                         | 2.60E+00      |  | 1.0            | 9.65E-08          | 2.5E-07      | 1.00E-03           | 3E-04 | 2.76E-08            | 7.2E-08      | NA                              | --    |
| Chromium(III)                   | 2.35E+00      |  | 1.0            | 9.65E-08          | 2.3E-07      | 1.50E+00           | 2E-07 | 2.76E-08            | 6.5E-08      | NA                              | --    |
| Chromium(VI)                    | 2.61E-01      |  | 1.0            | 9.65E-08          | 2.5E-08      | 3.00E-03           | 8E-06 | 2.76E-08            | 7.2E-09      | 5.00E-01                        | 7E-09 |
| Cobalt                          | 8.73E+00      |  | 1.0            | 9.65E-08          | 8.4E-07      | 3.00E-04           | 3E-03 | 2.76E-08            | 2.4E-07      | NA                              | --    |
| Iron                            | 3.39E+04      |  | 1.0            | 9.65E-08          | 3.3E-03      | 7.00E-01           | 5E-03 | 2.76E-08            | 9.4E-04      | NA                              | --    |
| Manganese                       | 1.40E+03      |  | 1.0            | 9.65E-08          | 1.4E-04      | 2.40E-02           | 6E-03 | 2.76E-08            | 3.9E-05      | NA                              | --    |
| Thallium                        | 7.28E-02      |  | 1.0            | 9.65E-08          | 7.0E-09      | 1.00E-05           | 7E-04 | 2.76E-08            | 2.0E-09      | NA                              | --    |
| Zinc                            | 5.59E+02      |  | 1.0            | 9.65E-08          | 5.4E-05      | 3.00E-01           | 2E-04 | 2.76E-08            | 1.5E-05      | NA                              | --    |

\*The EPC values for chromium were assumed to be 10% hexavalent chromium and 90% trivalent chromium.

\*\*The EPC value for arsenic represents the time-weighted concentration, adjusted for the soil-specific RBA for waste rock (0.06) and overbank (0.60)

Ctissue = game tissue concentration    DI = dietary intake    mg = milligram    RME = reasonable maximum exposure  
Csoil = soil concentration    HIF = human intake factor    NC = non-cancer    SF = slope factor  
CTE = cental tendency exposure    HQ = hazard quotient    RBA = relative bioavailblty    NA = not available  
d = day    kg = kilogram    RfD = reference dose    -- = not calculated

**TABLE D-14b**  
**RME RISK SUMMARY FOR THE HUNTER**  
*Bonita Peak Mining District*

**Panel A: RME Non-Cancer Risks**

| Chemical of Potential Concern | EU1                 |                   |                           |              | EU2                 |                   |                           |              | EU3                 |                   |                           |              | EU4                 |                   |                           |              |
|-------------------------------|---------------------|-------------------|---------------------------|--------------|---------------------|-------------------|---------------------------|--------------|---------------------|-------------------|---------------------------|--------------|---------------------|-------------------|---------------------------|--------------|
|                               | Ingestion of Grouse | Ingestion of Deer | Incidental Soil Ingestion | Total HI     | Ingestion of Grouse | Ingestion of Deer | Incidental Soil Ingestion | Total HI     | Ingestion of Grouse | Ingestion of Deer | Incidental Soil Ingestion | Total HI     | Ingestion of Grouse | Ingestion of Deer | Incidental Soil Ingestion | Total HI     |
| Antimony                      | --                  | --                | 7E-04                     | 7E-04        | --                  | --                | 4E-03                     | 4E-03        | --                  | --                | 4E-04                     | 4E-04        | --                  | --                | 4E-04                     | 4E-04        |
| Arsenic                       | --                  | --                | 1E-02                     | 1E-02        | --                  | --                | 7E-03                     | 7E-03        | --                  | --                | 7E-03                     | 7E-03        | --                  | --                | 3E-02                     | 3E-02        |
| Cadmium                       | 3E-03               | --                | 1E-03                     | 5E-03        | 3E-03               | --                | 5E-04                     | 4E-03        | 3E-03               | --                | 4E-04                     | 4E-03        | 3E-03               | --                | 3E-04                     | 3E-03        |
| Chromium(III)                 | 7E-05               | 5E-04             | 2E-07                     | 6E-04        |
| Chromium(VI)                  | 4E-03               | 3E-02             | 9E-06                     | 3E-02        | 4E-03               | 3E-02             | 1E-05                     | 3E-02        | 4E-03               | 3E-02             | 1E-05                     | 3E-02        | 4E-03               | 3E-02             | 8E-06                     | 3E-02        |
| Cobalt                        | --                  | --                | 3E-03                     | 3E-03        | --                  | --                | 2E-03                     | 2E-03        | --                  | --                | 2E-03                     | 2E-03        | --                  | --                | 3E-03                     | 3E-03        |
| Iron                          | --                  | 5E-02             | 3E-03                     | 5E-02        | --                  | 5E-02             | 3E-03                     | 5E-02        | --                  | 5E-02             | 4E-03                     | 5E-02        | --                  | 5E-02             | 5E-03                     | 5E-02        |
| Manganese                     | --                  | 3E-03             | 2E-02                     | 3E-02        | --                  | 3E-03             | 3E-02                     | 3E-02        | --                  | 3E-03             | 6E-03                     | 9E-03        | --                  | 3E-03             | 6E-03                     | 8E-03        |
| Mercury                       | --                  | --                | --                        | --           | --                  | --                | --                        | --           | --                  | --                | --                        | --           | --                  | --                | --                        | --           |
| Thallium                      | --                  | --                | 4E-03                     | 4E-03        | --                  | --                | 2E-03                     | 2E-03        | --                  | --                | 5E-03                     | 5E-03        | --                  | --                | 7E-04                     | 7E-04        |
| Zinc                          | 2E-03               | 1E-01             | 4E-04                     | 2E-01        | 2E-03               | 1E-01             | 4E-04                     | 2E-01        | 2E-03               | 1E-01             | 2E-04                     | 2E-01        | 2E-03               | 1E-01             | 2E-04                     | 2E-01        |
| <b>Total</b>                  | <b>1E-02</b>        | <b>2E-01</b>      | <b>5E-02</b>              | <b>3E-01</b> | <b>1E-02</b>        | <b>2E-01</b>      | <b>5E-02</b>              | <b>3E-01</b> | <b>1E-02</b>        | <b>2E-01</b>      | <b>3E-02</b>              | <b>3E-01</b> | <b>1E-02</b>        | <b>2E-01</b>      | <b>4E-02</b>              | <b>3E-01</b> |

**Panel B: RME Cancer Risks**

| Chemical of Potential Concern | EU1                 |                   |                           |              | EU2                 |                   |                           |              | EU3                 |                   |                           |              | EU4                 |                   |                           |              |
|-------------------------------|---------------------|-------------------|---------------------------|--------------|---------------------|-------------------|---------------------------|--------------|---------------------|-------------------|---------------------------|--------------|---------------------|-------------------|---------------------------|--------------|
|                               | Ingestion of Grouse | Ingestion of Deer | Incidental Soil Ingestion | Total Risk   | Ingestion of Grouse | Ingestion of Deer | Incidental Soil Ingestion | Total Risk   | Ingestion of Grouse | Ingestion of Deer | Incidental Soil Ingestion | Total Risk   | Ingestion of Grouse | Ingestion of Deer | Incidental Soil Ingestion | Total Risk   |
| Antimony                      | --                  | --                | --                        | --           | --                  | --                | --                        | --           | --                  | --                | --                        | --           | --                  | --                | --                        | --           |
| Arsenic                       | --                  | --                | 2E-06                     | 2E-06        | --                  | --                | 9E-07                     | 9E-07        | --                  | --                | 1E-06                     | 1E-06        | --                  | --                | 4E-06                     | 4E-06        |
| Cadmium                       | --                  | --                | --                        | --           | --                  | --                | --                        | --           | --                  | --                | --                        | --           | --                  | --                | --                        | --           |
| Chromium(III)                 | --                  | --                | --                        | --           | --                  | --                | --                        | --           | --                  | --                | --                        | --           | --                  | --                | --                        | --           |
| Chromium(VI)                  | 3E-06               | 2E-05             | 8E-09                     | 3E-05        | 3E-06               | 2E-05             | 9E-09                     | 3E-05        | 3E-06               | 2E-05             | 8E-09                     | 3E-05        | 3E-06               | 2E-05             | 7E-09                     | 3E-05        |
| Cobalt                        | --                  | --                | --                        | --           | --                  | --                | --                        | --           | --                  | --                | --                        | --           | --                  | --                | --                        | --           |
| Iron                          | --                  | --                | --                        | --           | --                  | --                | --                        | --           | --                  | --                | --                        | --           | --                  | --                | --                        | --           |
| Manganese                     | --                  | --                | --                        | --           | --                  | --                | --                        | --           | --                  | --                | --                        | --           | --                  | --                | --                        | --           |
| Mercury                       | --                  | --                | --                        | --           | --                  | --                | --                        | --           | --                  | --                | --                        | --           | --                  | --                | --                        | --           |
| Thallium                      | --                  | --                | --                        | --           | --                  | --                | --                        | --           | --                  | --                | --                        | --           | --                  | --                | --                        | --           |
| Zinc                          | --                  | --                | --                        | --           | --                  | --                | --                        | --           | --                  | --                | --                        | --           | --                  | --                | --                        | --           |
| <b>Total</b>                  | <b>3E-06</b>        | <b>2E-05</b>      | <b>2E-06</b>              | <b>3E-05</b> | <b>3E-06</b>        | <b>2E-05</b>      | <b>9E-07</b>              | <b>3E-05</b> | <b>3E-06</b>        | <b>2E-05</b>      | <b>1E-06</b>              | <b>3E-05</b> | <b>3E-06</b>        | <b>2E-05</b>      | <b>4E-06</b>              | <b>3E-05</b> |

**Notes:**  
-- = not calculated  
HI = hazard index  
RME = reasonable maximum exposure

**TABLE D-15a**  
**DETAILED RISK CALCULATIONS FOR THE ROAD WORKER IN EU1**  
*Bonita Peak Mining District*

**Panel A. CTE Scenario**  
**Inhalation Caused by Human Disturbance**

| Chemical of Potential Concern * | Cair (mg/m <sup>3</sup> ) |     | RBA (unitless) | Non Cancer Hazard |                         |              |       | Cancer Risk    |                         |                                        |       |
|---------------------------------|---------------------------|-----|----------------|-------------------|-------------------------|--------------|-------|----------------|-------------------------|----------------------------------------|-------|
|                                 |                           |     |                | TWF (unitless)    | EC (mg/m <sup>3</sup> ) | iRfC (mg/kg) | HQ    | TWF (unitless) | EC (µg/m <sup>3</sup> ) | iUR (µg/m <sup>3</sup> ) <sup>-1</sup> | Risk  |
| Antimony                        | --                        | [d] | 1.0            | 6.85E-02          | --                      | NA           | --    | 4.89E-03       | --                      | NA                                     | --    |
| Arsenic                         | --                        | [a] | 1.0            | 6.85E-02          | --                      | 1.50E-05     | --    | 4.89E-03       | --                      | 4.30E-03                               | --    |
| Cadmium                         | --                        | [d] | 1.0            | 6.85E-02          | --                      | 1.00E-05     | --    | 4.89E-03       | --                      | 1.80E-03                               | --    |
| Chromium(III)                   | 2.06E-04                  |     | 1.0            | 6.85E-02          | 1.41E-05                | NA           | --    | 4.89E-03       | 1.0E-03                 | NA                                     | --    |
| Chromium(VI)                    | 2.29E-05                  |     | 1.0            | 6.85E-02          | 1.57E-06                | 1.00E-04     | 2E-02 | 4.89E-03       | 1.1E-04                 | 8.40E-02                               | 9E-06 |
| Cobalt                          | --                        | [d] | 1.0            | 6.85E-02          | --                      | 6.00E-06     | --    | 4.89E-03       | --                      | 9.00E-03                               | --    |
| Iron                            | --                        | [d] | 1.0            | 6.85E-02          | --                      | NA           | --    | 4.89E-03       | --                      | NA                                     | --    |
| Manganese                       | 1.87E-04                  | [c] | 1.0            | 6.85E-02          | 1.28E-05                | 5.00E-05     | 3E-01 | 4.89E-03       | 9.1E-04                 | NA                                     | --    |
| Thallium                        | --                        | [d] | 1.0            | 6.85E-02          | --                      | NA           | --    | 4.89E-03       | --                      | NA                                     | --    |
| Zinc                            | --                        | [d] | 1.0            | 6.85E-02          | --                      | NA           | --    | 4.89E-03       | --                      | NA                                     | --    |

**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) |  | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|---------------|--|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |               |  |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | 1.44E+01      |  | 1.0            | 5.65E-07          | 8.1E-06      | 4.00E-04           | 2E-02 | 4.04E-08            | 5.8E-07      | NA                              | --    |
| Arsenic                         | 7.95E+01      |  | 0.08           | 5.65E-07          | 3.6E-06      | 3.00E-04           | 1E-02 | 4.04E-08            | 2.6E-07      | 1.50E+00                        | 4E-07 |
| Cadmium                         | 4.23E+00      |  | 1.0            | 5.65E-07          | 2.4E-06      | 1.00E-03           | 2E-03 | 4.04E-08            | 1.7E-07      | NA                              | --    |
| Chromium(III)                   | 5.17E+00      |  | 1.0            | 5.65E-07          | 2.9E-06      | 1.50E+00           | 2E-06 | 4.04E-08            | 2.1E-07      | NA                              | --    |
| Chromium(VI)                    | 5.74E-01      |  | 1.0            | 5.65E-07          | 3.2E-07      | 3.00E-03           | 1E-04 | 4.04E-08            | 2.3E-08      | 5.00E-01                        | 1E-08 |
| Cobalt                          | 1.19E+01      |  | 1.0            | 5.65E-07          | 6.7E-06      | 3.00E-04           | 2E-02 | 4.04E-08            | 4.8E-07      | NA                              | --    |
| Iron                            | 3.11E+04      |  | 1.0            | 5.65E-07          | 1.8E-02      | 7.00E-01           | 3E-02 | 4.04E-08            | 1.3E-03      | NA                              | --    |
| Manganese                       | 7.80E+03      |  | 1.0            | 5.65E-07          | 4.4E-03      | 2.40E-02           | 2E-01 | 4.04E-08            | 3.1E-04      | NA                              | --    |
| Thallium                        | 9.48E-01      |  | 1.0            | 5.65E-07          | 5.4E-07      | 1.00E-05           | 5E-02 | 4.04E-08            | 3.8E-08      | NA                              | --    |
| Zinc                            | 1.08E+03      |  | 1.0            | 5.65E-07          | 6.1E-04      | 3.00E-01           | 2E-03 | 4.04E-08            | 4.3E-05      | NA                              | --    |

**TABLE D-15a**  
**DETAILED RISK CALCULATIONS FOR THE ROAD WORKER IN EU1**  
*Bonita Peak Mining District*

**Panel B. RME Scenario**

**Inhalation Caused by Human Disturbance**

| Chemical of Potential Concern * | Cair (mg/m <sup>3</sup> ) |     | RBA (unitless) | Non Cancer Hazard |                         |              |       | Cancer Risk    |                         |                                        |       |
|---------------------------------|---------------------------|-----|----------------|-------------------|-------------------------|--------------|-------|----------------|-------------------------|----------------------------------------|-------|
|                                 |                           |     |                | TWF (unitless)    | EC (mg/m <sup>3</sup> ) | iRfC (mg/kg) | HQ    | TWF (unitless) | EC (µg/m <sup>3</sup> ) | iUR (µg/m <sup>3</sup> ) <sup>-1</sup> | Risk  |
| Antimony                        | --                        | [d] | 1.0            | 9.13E-02          | --                      | NA           | --    | 1.30E-02       | --                      | NA                                     | --    |
| Arsenic                         | --                        | [a] | 1.0            | 9.13E-02          | --                      | 1.50E-05     | --    | 1.30E-02       | --                      | 4.30E-03                               | --    |
| Cadmium                         | --                        | [d] | 1.0            | 9.13E-02          | --                      | 1.00E-05     | --    | 1.30E-02       | --                      | 1.80E-03                               | --    |
| Chromium(III)                   | 2.06E-04                  |     | 1.0            | 9.13E-02          | 1.88E-05                | NA           | --    | 1.30E-02       | 2.7E-03                 | NA                                     | --    |
| Chromium(VI)                    | 2.29E-05                  |     | 1.0            | 9.13E-02          | 2.09E-06                | 1.00E-04     | 2E-02 | 1.30E-02       | 3.0E-04                 | 8.40E-02                               | 3E-05 |
| Cobalt                          | --                        | [d] | 1.0            | 9.13E-02          | --                      | 6.00E-06     | --    | 1.30E-02       | --                      | 9.00E-03                               | --    |
| Iron                            | --                        | [d] | 1.0            | 9.13E-02          | --                      | NA           | --    | 1.30E-02       | --                      | NA                                     | --    |
| Manganese                       | 1.87E-04                  | [c] | 1.0            | 9.13E-02          | 1.71E-05                | 5.00E-05     | 3E-01 | 1.30E-02       | 2.4E-03                 | NA                                     | --    |
| Thallium                        | --                        | [d] | 1.0            | 9.13E-02          | --                      | NA           | --    | 1.30E-02       | --                      | NA                                     | --    |
| Zinc                            | --                        | [d] | 1.0            | 9.13E-02          | --                      | NA           | --    | 1.30E-02       | --                      | NA                                     | --    |

**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) |  | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|---------------|--|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |               |  |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | 1.44E+01      |  | 1.0            | 1.13E-06          | 1.6E-05      | 4.00E-04           | 4E-02 | 1.61E-07            | 2.3E-06      | NA                              | --    |
| Arsenic                         | 7.95E+01      |  | 0.08           | 1.13E-06          | 7.2E-06      | 3.00E-04           | 2E-02 | 1.61E-07            | 1.0E-06      | 1.50E+00                        | 2E-06 |
| Cadmium                         | 4.23E+00      |  | 1.0            | 1.13E-06          | 4.8E-06      | 1.00E-03           | 5E-03 | 1.61E-07            | 6.8E-07      | NA                              | --    |
| Chromium(III)                   | 5.17E+00      |  | 1.0            | 1.13E-06          | 5.8E-06      | 1.50E+00           | 4E-06 | 1.61E-07            | 8.3E-07      | NA                              | --    |
| Chromium(VI)                    | 5.74E-01      |  | 1.0            | 1.13E-06          | 6.5E-07      | 3.00E-03           | 2E-04 | 1.61E-07            | 9.3E-08      | 5.00E-01                        | 5E-08 |
| Cobalt                          | 1.19E+01      |  | 1.0            | 1.13E-06          | 1.3E-05      | 3.00E-04           | 4E-02 | 1.61E-07            | 1.9E-06      | NA                              | --    |
| Iron                            | 3.11E+04      |  | 1.0            | 1.13E-06          | 3.5E-02      | 7.00E-01           | 5E-02 | 1.61E-07            | 5.0E-03      | NA                              | --    |
| Manganese                       | 7.80E+03      |  | 1.0            | 1.13E-06          | 8.8E-03      | 2.40E-02           | 4E-01 | 1.61E-07            | 1.3E-03      | NA                              | --    |
| Thallium                        | 9.48E-01      |  | 1.0            | 1.13E-06          | 1.1E-06      | 1.00E-05           | 1E-01 | 1.61E-07            | 1.5E-07      | NA                              | --    |
| Zinc                            | 1.08E+03      |  | 1.0            | 1.13E-06          | 1.2E-03      | 3.00E-01           | 4E-03 | 1.61E-07            | 1.7E-04      | NA                              | --    |

\*The EPC values for chromium were assumed to be 10% hexavalent chromium and 90% trivalent chromium.

µg - microgram

Cair = air concentration

Csoil = soil concentration

d = day

DI = dietary intake

EC = exposure concentration

HIF = human intake factor

HQ = hazard quotient

kg = kilogram

m = meter

mg = milligram

NC = non-cancer

RBA = relative bioavailability

RfC = reference concentration

RfD = reference dose

SF = slope factor

TWF = time-weighting factor

NA = not available

-- = not calculated

**TABLE D-16a**  
**DETAILED RISK CALCULATIONS FOR THE ROAD WORKER IN EU2**  
*Bonita Peak Mining District*

**Panel A. CTE Scenario**  
**Inhalation Caused by Human Disturbance**

| Chemical of Potential Concern * | Cair (mg/m <sup>3</sup> ) |     | RBA (unitless) | Non Cancer Hazard |                         |              |       | Cancer Risk    |                         |                                        |       |
|---------------------------------|---------------------------|-----|----------------|-------------------|-------------------------|--------------|-------|----------------|-------------------------|----------------------------------------|-------|
|                                 |                           |     |                | TWF (unitless)    | EC (mg/m <sup>3</sup> ) | iRfC (mg/kg) | HQ    | TWF (unitless) | EC (ug/m <sup>3</sup> ) | iUR (ug/m <sup>3</sup> ) <sup>-1</sup> | Risk  |
| Antimony                        | --                        | [d] | 1.0            | 6.85E-02          | --                      | NA           | --    | 4.89E-03       | --                      | NA                                     | --    |
| Arsenic                         | --                        | [a] | 1.0            | 6.85E-02          | --                      | 1.50E-05     | --    | 4.89E-03       | --                      | 4.30E-03                               | --    |
| Cadmium                         | --                        | [d] | 1.0            | 6.85E-02          | --                      | 1.00E-05     | --    | 4.89E-03       | --                      | 1.80E-03                               | --    |
| Chromium(III)                   | 2.06E-04                  |     | 1.0            | 6.85E-02          | 1.41E-05                | NA           | --    | 4.89E-03       | 1.0E-03                 | NA                                     | --    |
| Chromium(VI)                    | 2.29E-05                  |     | 1.0            | 6.85E-02          | 1.57E-06                | 1.00E-04     | 2E-02 | 4.89E-03       | 1.1E-04                 | 8.40E-02                               | 9E-06 |
| Cobalt                          | --                        | [d] | 1.0            | 6.85E-02          | --                      | 6.00E-06     | --    | 4.89E-03       | --                      | 9.00E-03                               | --    |
| Iron                            | --                        | [d] | 1.0            | 6.85E-02          | --                      | NA           | --    | 4.89E-03       | --                      | NA                                     | --    |
| Manganese                       | 1.87E-04                  | [c] | 1.0            | 6.85E-02          | 1.28E-05                | 5.00E-05     | 3E-01 | 4.89E-03       | 9.1E-04                 | NA                                     | --    |
| Thallium                        | --                        | [d] | 1.0            | 6.85E-02          | --                      | NA           | --    | 4.89E-03       | --                      | NA                                     | --    |
| Zinc                            | --                        | [d] | 1.0            | 6.85E-02          | --                      | NA           | --    | 4.89E-03       | --                      | NA                                     | --    |

**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) |  | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|---------------|--|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |               |  |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | 3.78E+00      |  | 1.0            | 5.65E-07          | 2.1E-06      | 4.00E-04           | 5E-03 | 4.04E-08            | 1.5E-07      | NA                              | --    |
| Arsenic                         | 3.43E+01      |  | 0.08           | 5.65E-07          | 1.5E-06      | 3.00E-04           | 5E-03 | 4.04E-08            | 1.1E-07      | 1.50E+00                        | 2E-07 |
| Cadmium                         | 7.88E+00      |  | 1.0            | 5.65E-07          | 4.5E-06      | 1.00E-03           | 4E-03 | 4.04E-08            | 3.2E-07      | NA                              | --    |
| Chromium(III)                   | 4.19E+00      |  | 1.0            | 5.65E-07          | 2.4E-06      | 1.50E+00           | 2E-06 | 4.04E-08            | 1.7E-07      | NA                              | --    |
| Chromium(VI)                    | 4.65E-01      |  | 1.0            | 5.65E-07          | 2.6E-07      | 3.00E-03           | 9E-05 | 4.04E-08            | 1.9E-08      | 5.00E-01                        | 9E-09 |
| Cobalt                          | 6.80E+00      |  | 1.0            | 5.65E-07          | 3.8E-06      | 3.00E-04           | 1E-02 | 4.04E-08            | 2.7E-07      | NA                              | --    |
| Iron                            | 2.51E+04      |  | 1.0            | 5.65E-07          | 1.4E-02      | 7.00E-01           | 2E-02 | 4.04E-08            | 1.0E-03      | NA                              | --    |
| Manganese                       | 2.44E+03      |  | 1.0            | 5.65E-07          | 1.4E-03      | 2.40E-02           | 6E-02 | 4.04E-08            | 9.8E-05      | NA                              | --    |
| Thallium                        | 2.06E-01      |  | 1.0            | 5.65E-07          | 1.2E-07      | 1.00E-05           | 1E-02 | 4.04E-08            | 8.3E-09      | NA                              | --    |
| Zinc                            | 1.98E+03      |  | 1.0            | 5.65E-07          | 1.1E-03      | 3.00E-01           | 4E-03 | 4.04E-08            | 8.0E-05      | NA                              | --    |

**TABLE D-16a**  
**DETAILED RISK CALCULATIONS FOR THE ROAD WORKER IN EU2**  
*Bonita Peak Mining District*

**Panel B. RME Scenario**  
**Inhalation Caused by Human Disturbance**

| Chemical of Potential Concern * | Cair (mg/m <sup>3</sup> ) |     | RBA (unitless) | Non Cancer Hazard |                         |              |       | Cancer Risk    |                         |                                        |       |
|---------------------------------|---------------------------|-----|----------------|-------------------|-------------------------|--------------|-------|----------------|-------------------------|----------------------------------------|-------|
|                                 |                           |     |                | TWF (unitless)    | EC (mg/m <sup>3</sup> ) | iRfC (mg/kg) | HQ    | TWF (unitless) | EC (µg/m <sup>3</sup> ) | iUR (µg/m <sup>3</sup> ) <sup>-1</sup> | Risk  |
| Antimony                        | --                        | [d] | 1.0            | 9.13E-02          | --                      | NA           | --    | 1.30E-02       | --                      | NA                                     | --    |
| Arsenic                         | --                        | [a] | 1.0            | 9.13E-02          | --                      | 1.50E-05     | --    | 1.30E-02       | --                      | 4.30E-03                               | --    |
| Cadmium                         | --                        | [d] | 1.0            | 9.13E-02          | --                      | 1.00E-05     | --    | 1.30E-02       | --                      | 1.80E-03                               | --    |
| Chromium(III)                   | 2.06E-04                  |     | 1.0            | 9.13E-02          | 1.88E-05                | NA           | --    | 1.30E-02       | 2.7E-03                 | NA                                     | --    |
| Chromium(VI)                    | 2.29E-05                  |     | 1.0            | 9.13E-02          | 2.09E-06                | 1.00E-04     | 2E-02 | 1.30E-02       | 3.0E-04                 | 8.40E-02                               | 3E-05 |
| Cobalt                          | --                        | [d] | 1.0            | 9.13E-02          | --                      | 6.00E-06     | --    | 1.30E-02       | --                      | 9.00E-03                               | --    |
| Iron                            | --                        | [d] | 1.0            | 9.13E-02          | --                      | NA           | --    | 1.30E-02       | --                      | NA                                     | --    |
| Manganese                       | 1.87E-04                  | [c] | 1.0            | 9.13E-02          | 1.71E-05                | 5.00E-05     | 3E-01 | 1.30E-02       | 2.4E-03                 | NA                                     | --    |
| Thallium                        | --                        | [d] | 1.0            | 9.13E-02          | --                      | NA           | --    | 1.30E-02       | --                      | NA                                     | --    |
| Zinc                            | --                        | [d] | 1.0            | 9.13E-02          | --                      | NA           | --    | 1.30E-02       | --                      | NA                                     | --    |

**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) |  | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|---------------|--|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |               |  |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | 3.78E+00      |  | 1.0            | 1.13E-06          | 4.3E-06      | 4.00E-04           | 1E-02 | 1.61E-07            | 6.1E-07      | NA                              | --    |
| Arsenic                         | 3.43E+01      |  | 0.08           | 1.13E-06          | 3.1E-06      | 3.00E-04           | 1E-02 | 1.61E-07            | 4.4E-07      | 1.50E+00                        | 7E-07 |
| Cadmium                         | 7.88E+00      |  | 1.0            | 1.13E-06          | 8.9E-06      | 1.00E-03           | 9E-03 | 1.61E-07            | 1.3E-06      | NA                              | --    |
| Chromium(III)                   | 4.19E+00      |  | 1.0            | 1.13E-06          | 4.7E-06      | 1.50E+00           | 3E-06 | 1.61E-07            | 6.8E-07      | NA                              | --    |
| Chromium(VI)                    | 4.65E-01      |  | 1.0            | 1.13E-06          | 5.3E-07      | 3.00E-03           | 2E-04 | 1.61E-07            | 7.5E-08      | 5.00E-01                        | 4E-08 |
| Cobalt                          | 6.80E+00      |  | 1.0            | 1.13E-06          | 7.7E-06      | 3.00E-04           | 3E-02 | 1.61E-07            | 1.1E-06      | NA                              | --    |
| Iron                            | 2.51E+04      |  | 1.0            | 1.13E-06          | 2.8E-02      | 7.00E-01           | 4E-02 | 1.61E-07            | 4.0E-03      | NA                              | --    |
| Manganese                       | 2.44E+03      |  | 1.0            | 1.13E-06          | 2.8E-03      | 2.40E-02           | 1E-01 | 1.61E-07            | 3.9E-04      | NA                              | --    |
| Thallium                        | 2.06E-01      |  | 1.0            | 1.13E-06          | 2.3E-07      | 1.00E-05           | 2E-02 | 1.61E-07            | 3.3E-08      | NA                              | --    |
| Zinc                            | 1.98E+03      |  | 1.0            | 1.13E-06          | 2.2E-03      | 3.00E-01           | 7E-03 | 1.61E-07            | 3.2E-04      | NA                              | --    |

\*The EPC values for chromium were assumed to be 10% hexavalent chromium and 90% trivalent chromium.

|                             |                                |                            |
|-----------------------------|--------------------------------|----------------------------|
| µg - microgram              | HQ = hazard quotient           | RfD = reference dose       |
| Cair = air concentration    | kg = kilogram                  | SF = slope factor          |
| Csoil = soil concentration  | m = meter                      | TWF =time-weighting factor |
| d = day                     | mg = milligram                 | NA = not available         |
| DI = dietary intake         | NC = non-cancer                | -- = not calculated        |
| EC = exposure concentration | RBA = relative bioavailability |                            |
| HIF = human intake factor   | RfC = reference concentration  |                            |

**TABLE D-17a**  
**DETAILED RISK CALCULATIONS FOR THE ROAD WORKER IN EU3**  
*Bonita Peak Mining District*

**Panel A. CTE Scenario**  
**Inhalation Caused by Human Disturbance**

| Chemical of Potential Concern * | Cair (mg/m <sup>3</sup> ) |     | RBA (unitless) | Non Cancer Hazard |                         |              |       | Cancer Risk    |                         |                                        |       |
|---------------------------------|---------------------------|-----|----------------|-------------------|-------------------------|--------------|-------|----------------|-------------------------|----------------------------------------|-------|
|                                 |                           |     |                | TWF (unitless)    | EC (mg/m <sup>3</sup> ) | iRfC (mg/kg) | HQ    | TWF (unitless) | EC (ug/m <sup>3</sup> ) | iUR (ug/m <sup>3</sup> ) <sup>-1</sup> | Risk  |
| Antimony                        | --                        | [d] | 1.0            | 6.85E-02          | --                      | NA           | --    | 4.89E-03       | --                      | NA                                     | --    |
| Arsenic                         | --                        | [a] | 1.0            | 6.85E-02          | --                      | 1.50E-05     | --    | 4.89E-03       | --                      | 4.30E-03                               | --    |
| Cadmium                         | --                        | [d] | 1.0            | 6.85E-02          | --                      | 1.00E-05     | --    | 4.89E-03       | --                      | 1.80E-03                               | --    |
| Chromium(III)                   | 2.12E-04                  |     | 1.0            | 6.85E-02          | 1.45E-05                | NA           | --    | 4.89E-03       | 1.0E-03                 | NA                                     | --    |
| Chromium(VI)                    | 2.36E-05                  |     | 1.0            | 6.85E-02          | 1.62E-06                | 1.00E-04     | 2E-02 | 4.89E-03       | 1.2E-04                 | 8.40E-02                               | 1E-05 |
| Cobalt                          | --                        | [d] | 1.0            | 6.85E-02          | --                      | 6.00E-06     | --    | 4.89E-03       | --                      | 9.00E-03                               | --    |
| Iron                            | --                        | [d] | 1.0            | 6.85E-02          | --                      | NA           | --    | 4.89E-03       | --                      | NA                                     | --    |
| Manganese                       | 4.74E-04                  | [c] | 1.0            | 6.85E-02          | 3.25E-05                | 5.00E-05     | 6E-01 | 4.89E-03       | 2.3E-03                 | NA                                     | --    |
| Thallium                        | --                        | [d] | 1.0            | 6.85E-02          | --                      | NA           | --    | 4.89E-03       | --                      | NA                                     | --    |
| Zinc                            | --                        | [d] | 1.0            | 6.85E-02          | --                      | NA           | --    | 4.89E-03       | --                      | NA                                     | --    |

**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) |  | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|---------------|--|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |               |  |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | 1.73E+00      |  | 1.0            | 5.65E-07          | 9.8E-07      | 4.00E-04           | 2E-03 | 4.04E-08            | 7.0E-08      | NA                              | --    |
| Arsenic                         | 1.92E+01      |  | 0.08           | 5.65E-07          | 8.7E-07      | 3.00E-04           | 3E-03 | 4.04E-08            | 6.2E-08      | 1.50E+00                        | 9E-08 |
| Cadmium                         | 1.58E+00      |  | 1.0            | 5.65E-07          | 8.9E-07      | 1.00E-03           | 9E-04 | 4.04E-08            | 6.4E-08      | NA                              | --    |
| Chromium(III)                   | 6.22E+00      |  | 1.0            | 5.65E-07          | 3.5E-06      | 1.50E+00           | 2E-06 | 4.04E-08            | 2.5E-07      | NA                              | --    |
| Chromium(VI)                    | 6.91E-01      |  | 1.0            | 5.65E-07          | 3.9E-07      | 3.00E-03           | 1E-04 | 4.04E-08            | 2.8E-08      | 5.00E-01                        | 1E-08 |
| Cobalt                          | 8.09E+00      |  | 1.0            | 5.65E-07          | 4.6E-06      | 3.00E-04           | 2E-02 | 4.04E-08            | 3.3E-07      | NA                              | --    |
| Iron                            | 1.22E+05      |  | 1.0            | 5.65E-07          | 6.9E-02      | 7.00E-01           | 1E-01 | 4.04E-08            | 4.9E-03      | NA                              | --    |
| Manganese                       | 9.36E+02      |  | 1.0            | 5.65E-07          | 5.3E-04      | 2.40E-02           | 2E-02 | 4.04E-08            | 3.8E-05      | NA                              | --    |
| Thallium                        | 2.05E-01      |  | 1.0            | 5.65E-07          | 1.2E-07      | 1.00E-05           | 1E-02 | 4.04E-08            | 8.3E-09      | NA                              | --    |
| Zinc                            | 6.59E+02      |  | 1.0            | 5.65E-07          | 3.7E-04      | 3.00E-01           | 1E-03 | 4.04E-08            | 2.7E-05      | NA                              | --    |

**TABLE D-17a**  
**DETAILED RISK CALCULATIONS FOR THE ROAD WORKER IN EU3**  
*Bonita Peak Mining District*

**Panel B. RME Scenario**  
**Inhalation Caused by Human Disturbance**

| Chemical of Potential Concern * | Cair (mg/m <sup>3</sup> ) |     | RBA (unitless) | Non Cancer Hazard |                         |              |       | Cancer Risk    |                         |                                        |       |
|---------------------------------|---------------------------|-----|----------------|-------------------|-------------------------|--------------|-------|----------------|-------------------------|----------------------------------------|-------|
|                                 |                           |     |                | TWF (unitless)    | EC (mg/m <sup>3</sup> ) | iRfC (mg/kg) | HQ    | TWF (unitless) | EC (µg/m <sup>3</sup> ) | iUR (µg/m <sup>3</sup> ) <sup>-1</sup> | Risk  |
| Antimony                        | --                        | [d] | 1.0            | 9.13E-02          | --                      | NA           | --    | 1.30E-02       | --                      | NA                                     | --    |
| Arsenic                         | --                        | [a] | 1.0            | 9.13E-02          | --                      | 1.50E-05     | --    | 1.30E-02       | --                      | 4.30E-03                               | --    |
| Cadmium                         | --                        | [d] | 1.0            | 9.13E-02          | --                      | 1.00E-05     | --    | 1.30E-02       | --                      | 1.80E-03                               | --    |
| Chromium(III)                   | 2.12E-04                  |     | 1.0            | 9.13E-02          | 1.94E-05                | NA           | --    | 1.30E-02       | 2.8E-03                 | NA                                     | --    |
| Chromium(VI)                    | 2.36E-05                  |     | 1.0            | 9.13E-02          | 2.16E-06                | 1.00E-04     | 2E-02 | 1.30E-02       | 3.1E-04                 | 8.40E-02                               | 3E-05 |
| Cobalt                          | --                        | [d] | 1.0            | 9.13E-02          | --                      | 6.00E-06     | --    | 1.30E-02       | --                      | 9.00E-03                               | --    |
| Iron                            | --                        | [d] | 1.0            | 9.13E-02          | --                      | NA           | --    | 1.30E-02       | --                      | NA                                     | --    |
| Manganese                       | 4.74E-04                  | [c] | 1.0            | 9.13E-02          | 4.33E-05                | 5.00E-05     | 9E-01 | 1.30E-02       | 6.2E-03                 | NA                                     | --    |
| Thallium                        | --                        | [d] | 1.0            | 9.13E-02          | --                      | NA           | --    | 1.30E-02       | --                      | NA                                     | --    |
| Zinc                            | --                        | [d] | 1.0            | 9.13E-02          | --                      | NA           | --    | 1.30E-02       | --                      | NA                                     | --    |

**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) |  | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|---------------|--|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |               |  |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | 1.73E+00      |  | 1.0            | 1.13E-06          | 2.0E-06      | 4.00E-04           | 5E-03 | 1.61E-07            | 2.8E-07      | NA                              | --    |
| Arsenic                         | 1.92E+01      |  | 0.08           | 1.13E-06          | 1.7E-06      | 3.00E-04           | 6E-03 | 1.61E-07            | 2.5E-07      | 1.50E+00                        | 4E-07 |
| Cadmium                         | 1.58E+00      |  | 1.0            | 1.13E-06          | 1.8E-06      | 1.00E-03           | 2E-03 | 1.61E-07            | 2.6E-07      | NA                              | --    |
| Chromium(III)                   | 6.22E+00      |  | 1.0            | 1.13E-06          | 7.0E-06      | 1.50E+00           | 5E-06 | 1.61E-07            | 1.0E-06      | NA                              | --    |
| Chromium(VI)                    | 6.91E-01      |  | 1.0            | 1.13E-06          | 7.8E-07      | 3.00E-03           | 3E-04 | 1.61E-07            | 1.1E-07      | 5.00E-01                        | 6E-08 |
| Cobalt                          | 8.09E+00      |  | 1.0            | 1.13E-06          | 9.1E-06      | 3.00E-04           | 3E-02 | 1.61E-07            | 1.3E-06      | NA                              | --    |
| Iron                            | 1.22E+05      |  | 1.0            | 1.13E-06          | 1.4E-01      | 7.00E-01           | 2E-01 | 1.61E-07            | 2.0E-02      | NA                              | --    |
| Manganese                       | 9.36E+02      |  | 1.0            | 1.13E-06          | 1.1E-03      | 2.40E-02           | 4E-02 | 1.61E-07            | 1.5E-04      | NA                              | --    |
| Thallium                        | 2.05E-01      |  | 1.0            | 1.13E-06          | 2.3E-07      | 1.00E-05           | 2E-02 | 1.61E-07            | 3.3E-08      | NA                              | --    |
| Zinc                            | 6.59E+02      |  | 1.0            | 1.13E-06          | 7.4E-04      | 3.00E-01           | 2E-03 | 1.61E-07            | 1.1E-04      | NA                              | --    |

\*The EPC values for chromium were assumed to be 10% hexavalent chromium and 90% trivalent chromium.

|                             |                               |                            |
|-----------------------------|-------------------------------|----------------------------|
| µg - microgram              | HQ = hazard quotient          | RfD = reference dose       |
| Cair = air concentration    | kg = kilogram                 | SF = slope factor          |
| Csoil = soil concentration  | m = meter                     | TWF =time-weighting factor |
| d = day                     | mg = milligram                | NA = not available         |
| DI = dietary intake         | NC = non-cancer               | -- = not calculated        |
| EC = exposure concentration | RBA = relative bioavailbilty  |                            |
| HIF = human intake factor   | RfC = reference concentration |                            |

**TABLE D-18a**  
**DETAILED RISK CALCULATIONS FOR THE ROAD WORKER IN EU4**  
*Bonita Peak Mining District*

**Panel A. CTE Scenario**  
**Inhalation Caused by Human Disturbance**

| Chemical of Potential Concern * | Cair (mg/m <sup>3</sup> ) |     | RBA (unitless) | Non Cancer Hazard |                         |              |       | Cancer Risk    |                         |                                        |       |
|---------------------------------|---------------------------|-----|----------------|-------------------|-------------------------|--------------|-------|----------------|-------------------------|----------------------------------------|-------|
|                                 |                           |     |                | TWF (unitless)    | EC (mg/m <sup>3</sup> ) | iRfC (mg/kg) | HQ    | TWF (unitless) | EC (ug/m <sup>3</sup> ) | iUR (ug/m <sup>3</sup> ) <sup>-1</sup> | Risk  |
| Antimony                        | --                        | [d] | 1.0            | 6.85E-02          | --                      | NA           | --    | 4.89E-03       | --                      | NA                                     | --    |
| Arsenic                         | --                        | [a] | 1.0            | 6.85E-02          | --                      | 1.50E-05     | --    | 4.89E-03       | --                      | 4.30E-03                               | --    |
| Cadmium                         | --                        | [d] | 1.0            | 6.85E-02          | --                      | 1.00E-05     | --    | 4.89E-03       | --                      | 1.80E-03                               | --    |
| Chromium(III)                   | 2.18E-04                  |     | 1.0            | 6.85E-02          | 1.49E-05                | NA           | --    | 4.89E-03       | 1.1E-03                 | NA                                     | --    |
| Chromium(VI)                    | 2.42E-05                  |     | 1.0            | 6.85E-02          | 1.66E-06                | 1.00E-04     | 2E-02 | 4.89E-03       | 1.2E-04                 | 8.40E-02                               | 1E-05 |
| Cobalt                          | --                        | [d] | 1.0            | 6.85E-02          | --                      | 6.00E-06     | --    | 4.89E-03       | --                      | 9.00E-03                               | --    |
| Iron                            | --                        | [d] | 1.0            | 6.85E-02          | --                      | NA           | --    | 4.89E-03       | --                      | NA                                     | --    |
| Manganese                       | 5.58E-05                  | [c] | 1.0            | 6.85E-02          | 3.82E-06                | 5.00E-05     | 8E-02 | 4.89E-03       | 2.7E-04                 | NA                                     | --    |
| Thallium                        | --                        | [d] | 1.0            | 6.85E-02          | --                      | NA           | --    | 4.89E-03       | --                      | NA                                     | --    |
| Zinc                            | --                        | [d] | 1.0            | 6.85E-02          | --                      | NA           | --    | 4.89E-03       | --                      | NA                                     | --    |

**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) |     | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|---------------|-----|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |               |     |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | 6.62E-01      |     | 1.0            | 5.65E-07          | 3.7E-07      | 4.00E-04           | 9E-04 | 4.04E-08            | 2.7E-08      | NA                              | --    |
| Arsenic                         | 1.54E+01      |     | 0.08           | 5.65E-07          | 7.0E-07      | 3.00E-04           | 2E-03 | 4.04E-08            | 5.0E-08      | 1.50E+00                        | 7E-08 |
| Cadmium                         | 6.48E+01      | [c] | 1.0            | 5.65E-07          | 3.7E-05      | 1.00E-03           | 4E-02 | 4.04E-08            | 2.6E-06      | NA                              | --    |
| Chromium(III)                   | 6.66E+00      |     | 1.0            | 5.65E-07          | 3.8E-06      | 1.50E+00           | 3E-06 | 4.04E-08            | 2.7E-07      | NA                              | --    |
| Chromium(VI)                    | 7.40E-01      |     | 1.0            | 5.65E-07          | 4.2E-07      | 3.00E-03           | 1E-04 | 4.04E-08            | 3.0E-08      | 5.00E-01                        | 1E-08 |
| Cobalt                          | 2.03E+01      |     | 1.0            | 5.65E-07          | 1.1E-05      | 3.00E-04           | 4E-02 | 4.04E-08            | 8.2E-07      | NA                              | --    |
| Iron                            | 3.13E+04      |     | 1.0            | 5.65E-07          | 1.8E-02      | 7.00E-01           | 3E-02 | 4.04E-08            | 1.3E-03      | NA                              | --    |
| Manganese                       | 1.98E+04      | [c] | 1.0            | 5.65E-07          | 1.1E-02      | 2.40E-02           | 5E-01 | 4.04E-08            | 8.0E-04      | NA                              | --    |
| Thallium                        | 1.10E-01      |     | 1.0            | 5.65E-07          | 6.2E-08      | 1.00E-05           | 6E-03 | 4.04E-08            | 4.4E-09      | NA                              | --    |
| Zinc                            | 5.97E+03      | [c] | 1.0            | 5.65E-07          | 3.4E-03      | 3.00E-01           | 1E-02 | 4.04E-08            | 2.4E-04      | NA                              | --    |

**TABLE D-18a**  
**DETAILED RISK CALCULATIONS FOR THE ROAD WORKER IN EU4**  
*Bonita Peak Mining District*

**Panel B. RME Scenario**  
**Inhalation Caused by Human Disturbance**

| Chemical of Potential Concern * | Cair (mg/m <sup>3</sup> ) |     | RBA (unitless) | Non Cancer Hazard |                         |              |       | Cancer Risk    |                         |                                        |       |
|---------------------------------|---------------------------|-----|----------------|-------------------|-------------------------|--------------|-------|----------------|-------------------------|----------------------------------------|-------|
|                                 |                           |     |                | TWF (unitless)    | EC (mg/m <sup>3</sup> ) | iRfC (mg/kg) | HQ    | TWF (unitless) | EC (µg/m <sup>3</sup> ) | iUR (µg/m <sup>3</sup> ) <sup>-1</sup> | Risk  |
| Antimony                        | --                        | [d] | 1.0            | 9.13E-02          | --                      | NA           | --    | 1.30E-02       | --                      | NA                                     | --    |
| Arsenic                         | --                        | [a] | 1.0            | 9.13E-02          | --                      | 1.50E-05     | --    | 1.30E-02       | --                      | 4.30E-03                               | --    |
| Cadmium                         | --                        | [d] | 1.0            | 9.13E-02          | --                      | 1.00E-05     | --    | 1.30E-02       | --                      | 1.80E-03                               | --    |
| Chromium(III)                   | 2.18E-04                  |     | 1.0            | 9.13E-02          | 1.99E-05                | NA           | --    | 1.30E-02       | 2.8E-03                 | NA                                     | --    |
| Chromium(VI)                    | 2.42E-05                  |     | 1.0            | 9.13E-02          | 2.21E-06                | 1.00E-04     | 2E-02 | 1.30E-02       | 3.2E-04                 | 8.40E-02                               | 3E-05 |
| Cobalt                          | --                        | [d] | 1.0            | 9.13E-02          | --                      | 6.00E-06     | --    | 1.30E-02       | --                      | 9.00E-03                               | --    |
| Iron                            | --                        | [d] | 1.0            | 9.13E-02          | --                      | NA           | --    | 1.30E-02       | --                      | NA                                     | --    |
| Manganese                       | 5.58E-05                  | [c] | 1.0            | 9.13E-02          | 5.10E-06                | 5.00E-05     | 1E-01 | 1.30E-02       | 7.3E-04                 | NA                                     | --    |
| Thallium                        | --                        | [d] | 1.0            | 9.13E-02          | --                      | NA           | --    | 1.30E-02       | --                      | NA                                     | --    |
| Zinc                            | --                        | [d] | 1.0            | 9.13E-02          | --                      | NA           | --    | 1.30E-02       | --                      | NA                                     | --    |

**Incidental Ingestion of Soil**

| Chemical of Potential Concern * | Csoil (mg/kg) |     | RBA (unitless) | Non Cancer Hazard |              |                    |       | Cancer Risk         |              |                                 |       |
|---------------------------------|---------------|-----|----------------|-------------------|--------------|--------------------|-------|---------------------|--------------|---------------------------------|-------|
|                                 |               |     |                | HIFNC (kg/kg d)   | DI (mg/kg d) | Oral RfD (mg/kg d) | HQ    | HIFCancer (kg/kg d) | DI (mg/kg d) | Oral SF (mg/kg d) <sup>-1</sup> | Risk  |
| Antimony                        | 6.62E-01      |     | 1.0            | 1.13E-06          | 7.5E-07      | 4.00E-04           | 2E-03 | 1.61E-07            | 1.1E-07      | NA                              | --    |
| Arsenic                         | 1.54E+01      |     | 0.08           | 1.13E-06          | 1.4E-06      | 3.00E-04           | 5E-03 | 1.61E-07            | 2.0E-07      | 1.50E+00                        | 3E-07 |
| Cadmium                         | 6.48E+01      | [c] | 1.0            | 1.13E-06          | 7.3E-05      | 1.00E-03           | 7E-02 | 1.61E-07            | 1.0E-05      | NA                              | --    |
| Chromium(III)                   | 6.66E+00      |     | 1.0            | 1.13E-06          | 7.5E-06      | 1.50E+00           | 5E-06 | 1.61E-07            | 1.1E-06      | NA                              | --    |
| Chromium(VI)                    | 7.40E-01      |     | 1.0            | 1.13E-06          | 8.4E-07      | 3.00E-03           | 3E-04 | 1.61E-07            | 1.2E-07      | 5.00E-01                        | 6E-08 |
| Cobalt                          | 2.03E+01      |     | 1.0            | 1.13E-06          | 2.3E-05      | 3.00E-04           | 8E-02 | 1.61E-07            | 3.3E-06      | NA                              | --    |
| Iron                            | 3.13E+04      |     | 1.0            | 1.13E-06          | 3.5E-02      | 7.00E-01           | 5E-02 | 1.61E-07            | 5.1E-03      | NA                              | --    |
| Manganese                       | 1.98E+04      | [c] | 1.0            | 1.13E-06          | 2.2E-02      | 2.40E-02           | 9E-01 | 1.61E-07            | 3.2E-03      | NA                              | --    |
| Thallium                        | 1.10E-01      |     | 1.0            | 1.13E-06          | 1.2E-07      | 1.00E-05           | 1E-02 | 1.61E-07            | 1.8E-08      | NA                              | --    |
| Zinc                            | 5.97E+03      | [c] | 1.0            | 1.13E-06          | 6.7E-03      | 3.00E-01           | 2E-02 | 1.61E-07            | 9.6E-04      | NA                              | --    |

\*The EPC values for chromium were assumed to be 10% hexavalent chromium and 90% trivalent chromium.

|                             |                               |                            |
|-----------------------------|-------------------------------|----------------------------|
| µg - microgram              | HQ = hazard quotient          | RfD = reference dose       |
| Cair = air concentration    | kg = kilogram                 | SF = slope factor          |
| Csoil = soil concentration  | m = meter                     | TWF =time-weighting factor |
| d = day                     | mg = milligram                | NA = not available         |
| DI = dietary intake         | NC = non-cancer               | -- = not calculated        |
| EC = exposure concentration | RBA = relative bioavailbilty  |                            |
| HIF = human intake factor   | RfC = reference concentration |                            |

**TABLE D-18b**

**RME RISK SUMMARY FOR THE ROAD WORKER**

*Bonita Peak Mining District*

**Panel A: RME Non-Cancer Risks**

| Chemical of Potential Concern | EU1             |                           |              | EU2             |                           |              | EU3             |                           |              | EU4             |                           |              |
|-------------------------------|-----------------|---------------------------|--------------|-----------------|---------------------------|--------------|-----------------|---------------------------|--------------|-----------------|---------------------------|--------------|
|                               | Soil Inhalation | Incidental Soil Ingestion | Total HI     | Soil Inhalation | Incidental Soil Ingestion | Total HI     | Soil Inhalation | Incidental Soil Ingestion | Total HI     | Soil Inhalation | Incidental Soil Ingestion | Total HI     |
| Antimony                      | --              | 4E-02                     | 4E-02        | --              | 1E-02                     | 1E-02        | --              | 5E-03                     | 5E-03        | --              | 2E-03                     | 2E-03        |
| Arsenic                       | --              | 2E-02                     | 2E-02        | --              | 1E-02                     | 1E-02        | --              | 6E-03                     | 6E-03        | --              | 5E-03                     | 5E-03        |
| Cadmium                       | --              | 5E-03                     | 5E-03        | --              | 9E-03                     | 9E-03        | --              | 2E-03                     | 2E-03        | --              | 7E-02                     | 7E-02        |
| Chromium(III)                 | --              | 4E-06                     | 4E-06        | --              | 3E-06                     | 3E-06        | --              | 5E-06                     | 5E-06        | --              | 5E-06                     | 5E-06        |
| Chromium(VI)                  | 2E-02           | 2E-04                     | 2E-02        | 2E-02           | 2E-04                     | 2E-02        | 2E-02           | 3E-04                     | 2E-02        | 2E-02           | 3E-04                     | 2E-02        |
| Cobalt                        | --              | 4E-02                     | 4E-02        | --              | 3E-02                     | 3E-02        | --              | 3E-02                     | 3E-02        | --              | 8E-02                     | 8E-02        |
| Iron                          | --              | 5E-02                     | 5E-02        | --              | 4E-02                     | 4E-02        | --              | 2E-01                     | 2E-01        | --              | 5E-02                     | 5E-02        |
| Manganese                     | 3E-01           | 4E-01                     | 7E-01        | 3E-01           | 1E-01                     | 5E-01        | 9E-01           | 4E-02                     | 9E-01        | 1E-01           | 9E-01                     | 1E+00        |
| Thallium                      | --              | 1E-01                     | 1E-01        | --              | 2E-02                     | 2E-02        | --              | 2E-02                     | 2E-02        | --              | 1E-02                     | 1E-02        |
| Zinc                          | --              | 4E-03                     | 4E-03        | --              | 7E-03                     | 7E-03        | --              | 2E-03                     | 2E-03        | --              | 2E-02                     | 2E-02        |
| <b>Total</b>                  | <b>4E-01</b>    | <b>6E-01</b>              | <b>1E+00</b> | <b>4E-01</b>    | <b>2E-01</b>              | <b>6E-01</b> | <b>9E-01</b>    | <b>3E-01</b>              | <b>1E+00</b> | <b>1E-01</b>    | <b>1E+00</b>              | <b>1E+00</b> |

**Panel B: RME Cancer Risks**

| Chemical of Potential Concern | EU1             |                           |              | EU2             |                           |              | EU3             |                           |              | EU4             |                           |              |
|-------------------------------|-----------------|---------------------------|--------------|-----------------|---------------------------|--------------|-----------------|---------------------------|--------------|-----------------|---------------------------|--------------|
|                               | Soil Inhalation | Incidental Soil Ingestion | Total Risk   | Soil Inhalation | Incidental Soil Ingestion | Total Risk   | Soil Inhalation | Incidental Soil Ingestion | Total Risk   | Soil Inhalation | Incidental Soil Ingestion | Total Risk   |
| Antimony                      | --              | --                        | --           | --              | --                        | --           | --              | --                        | --           | --              | --                        | --           |
| Arsenic                       | --              | 2E-06                     | 2E-06        | --              | 7E-07                     | 7E-07        | --              | 4E-07                     | 4E-07        | --              | 3E-07                     | 3E-07        |
| Cadmium                       | --              | --                        | --           | --              | --                        | --           | --              | --                        | --           | --              | --                        | --           |
| Chromium(III)                 | --              | --                        | --           | --              | --                        | --           | --              | --                        | --           | --              | --                        | --           |
| Chromium(VI)                  | 3E-05           | 5E-08                     | 3E-05        | 3E-05           | 4E-08                     | 3E-05        | 3E-05           | 6E-08                     | 3E-05        | 3E-05           | 6E-08                     | 3E-05        |
| Cobalt                        | --              | --                        | --           | --              | --                        | --           | --              | --                        | --           | --              | --                        | --           |
| Iron                          | --              | --                        | --           | --              | --                        | --           | --              | --                        | --           | --              | --                        | --           |
| Manganese                     | --              | --                        | --           | --              | --                        | --           | --              | --                        | --           | --              | --                        | --           |
| Thallium                      | --              | --                        | --           | --              | --                        | --           | --              | --                        | --           | --              | --                        | --           |
| Zinc                          | --              | --                        | --           | --              | --                        | --           | --              | --                        | --           | --              | --                        | --           |
| <b>Total</b>                  | <b>3E-05</b>    | <b>2E-06</b>              | <b>3E-05</b> | <b>3E-05</b>    | <b>7E-07</b>              | <b>3E-05</b> | <b>3E-05</b>    | <b>4E-07</b>              | <b>3E-05</b> | <b>3E-05</b>    | <b>4E-07</b>              | <b>3E-05</b> |

**Notes:**

-- = not calculated

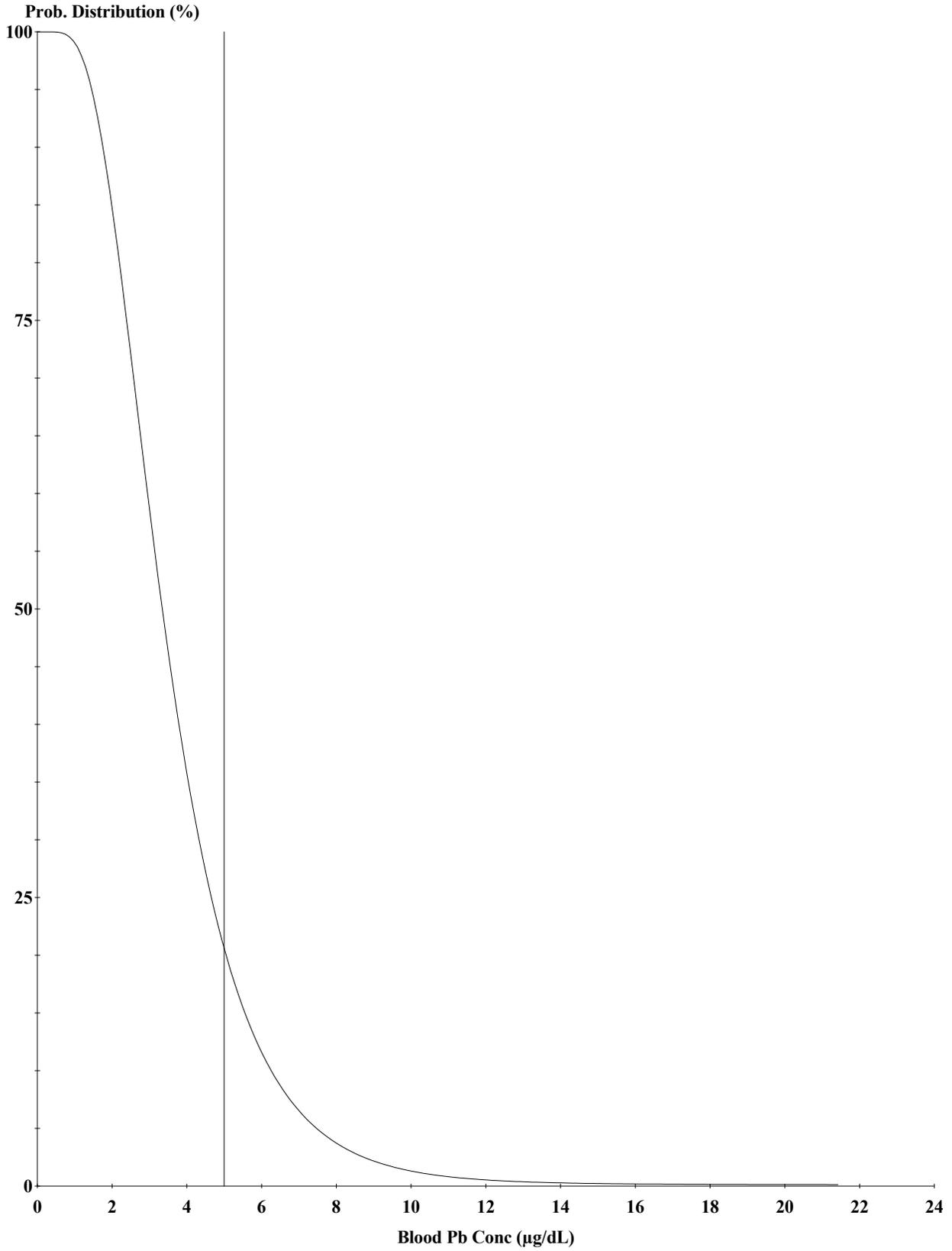
HI = hazard index

RME = reasonable maximum exposure

# Appendix E

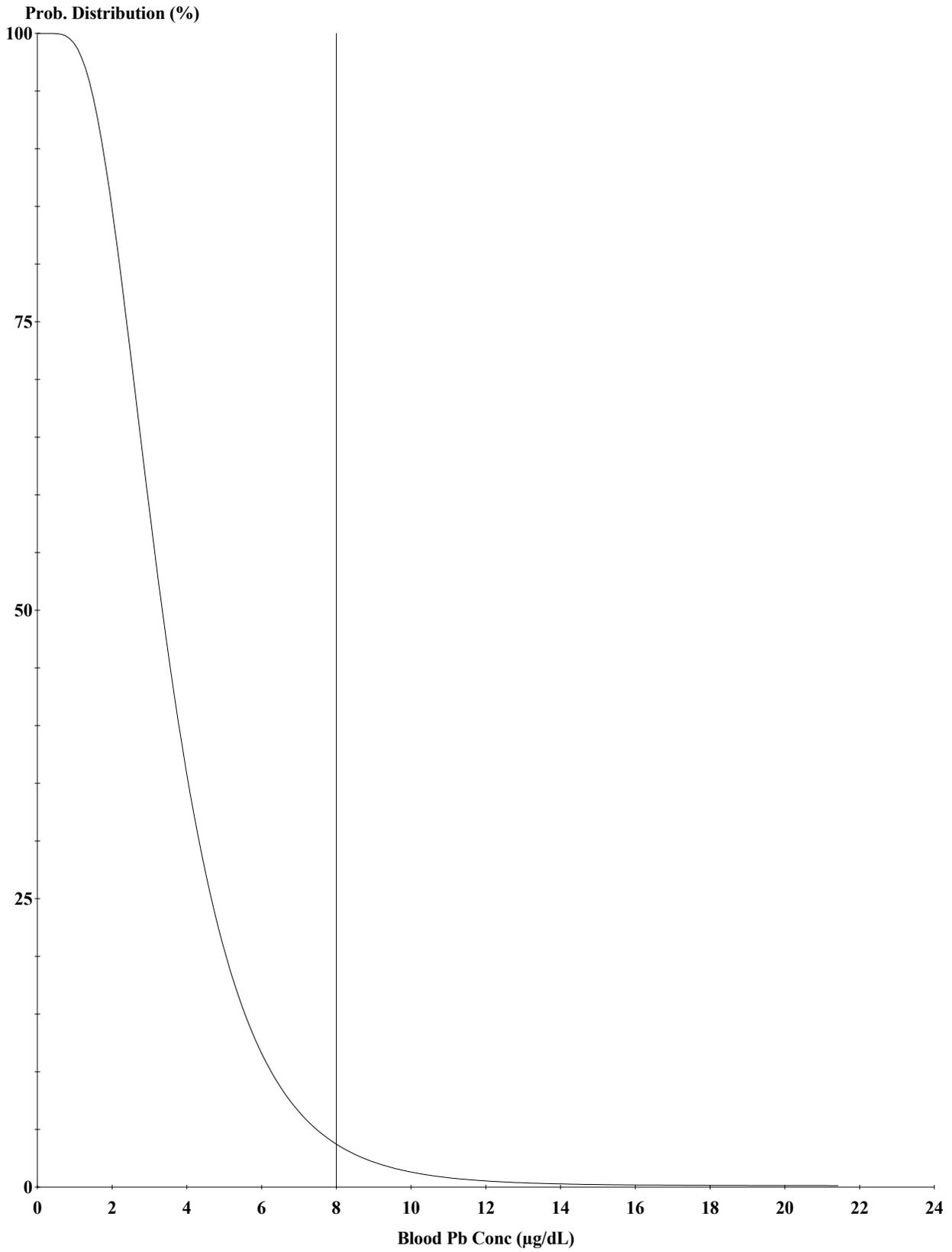
## IEUBK Output Files

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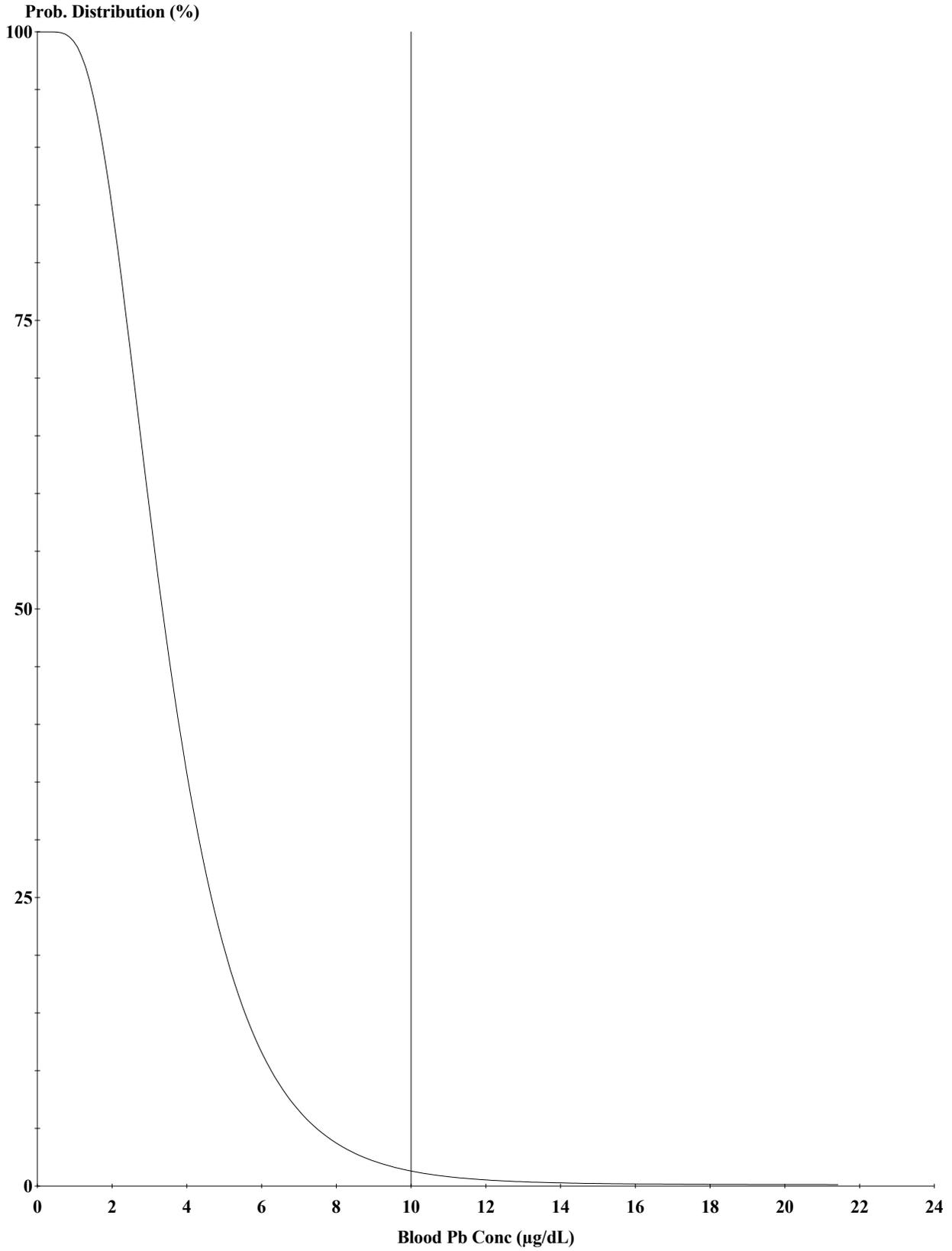
**Cutoff = 5.000 µg/dl**  
**Geo Mean = 3.504**  
**GSD = 1.600**  
**% Above = 22.478**  
**Dispersed Camper**

**Age Range = User Designated: Ages 12 - 72 months**  
**Run Mode = Research**



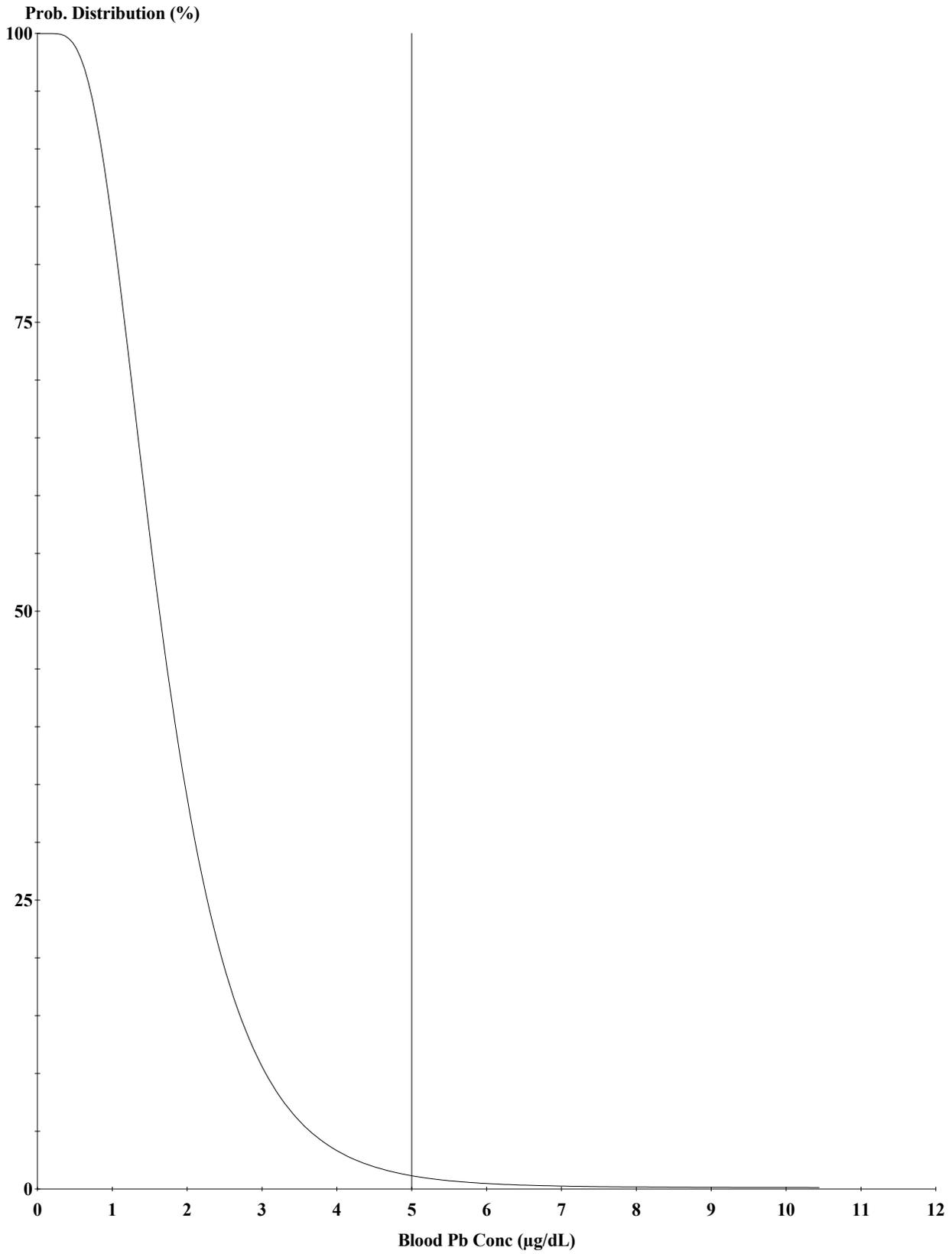
**Cutoff = 8.000  $\mu\text{g/dl}$**   
**Geo Mean = 3.504**  
**GSD = 1.600**  
**% Above = 3.953**  
**Dispersed Camper**

**Age Range = User Designated: Ages 12 - 72 months**  
**Run Mode = Research**



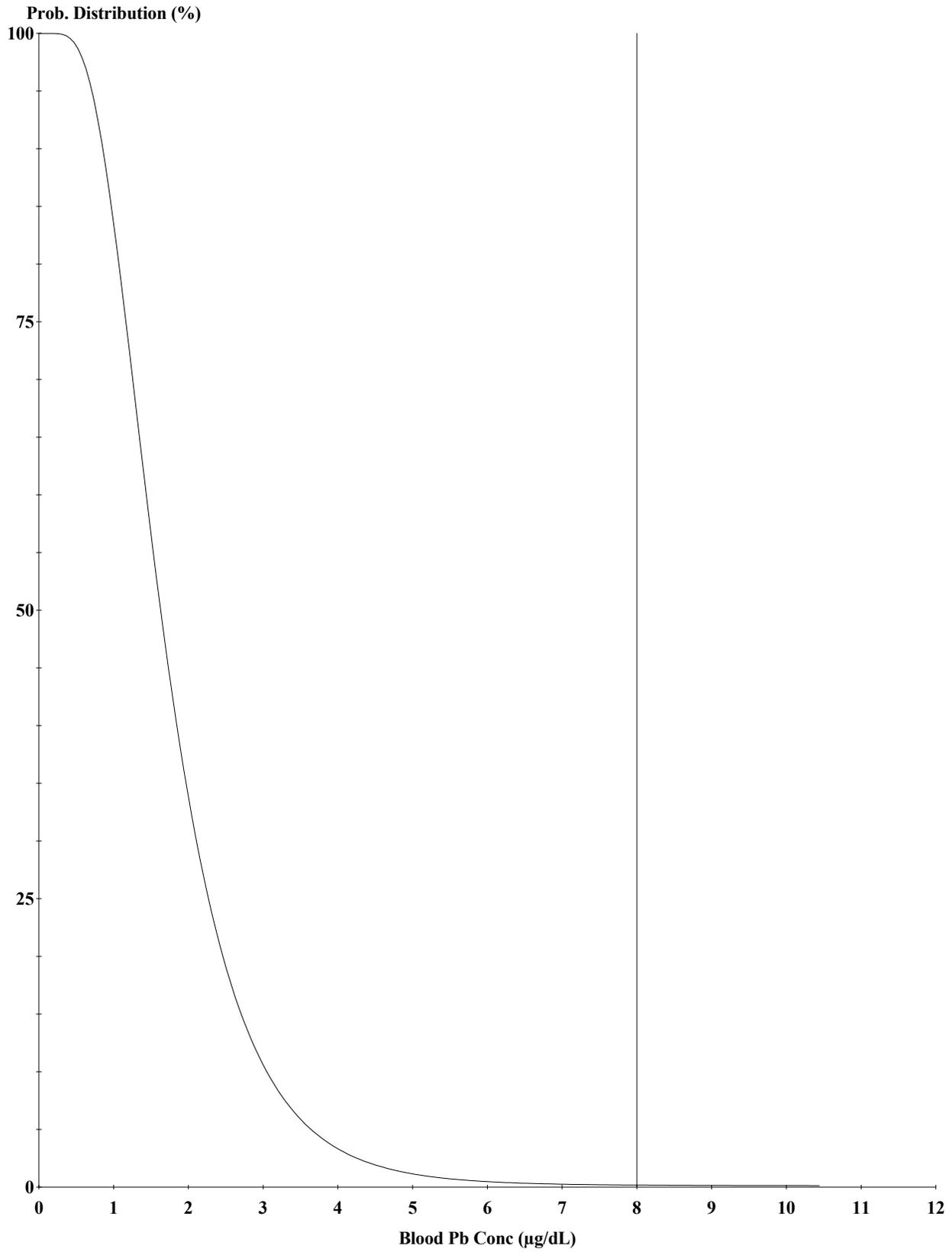
**Cutoff = 10.000 µg/dl**  
**Geo Mean = 3.504**  
**GSD = 1.600**  
**% Above = 1.284**  
**Dispersed Camper**

**Age Range = User Designated: Ages 12 - 72 months**  
**Run Mode = Research**



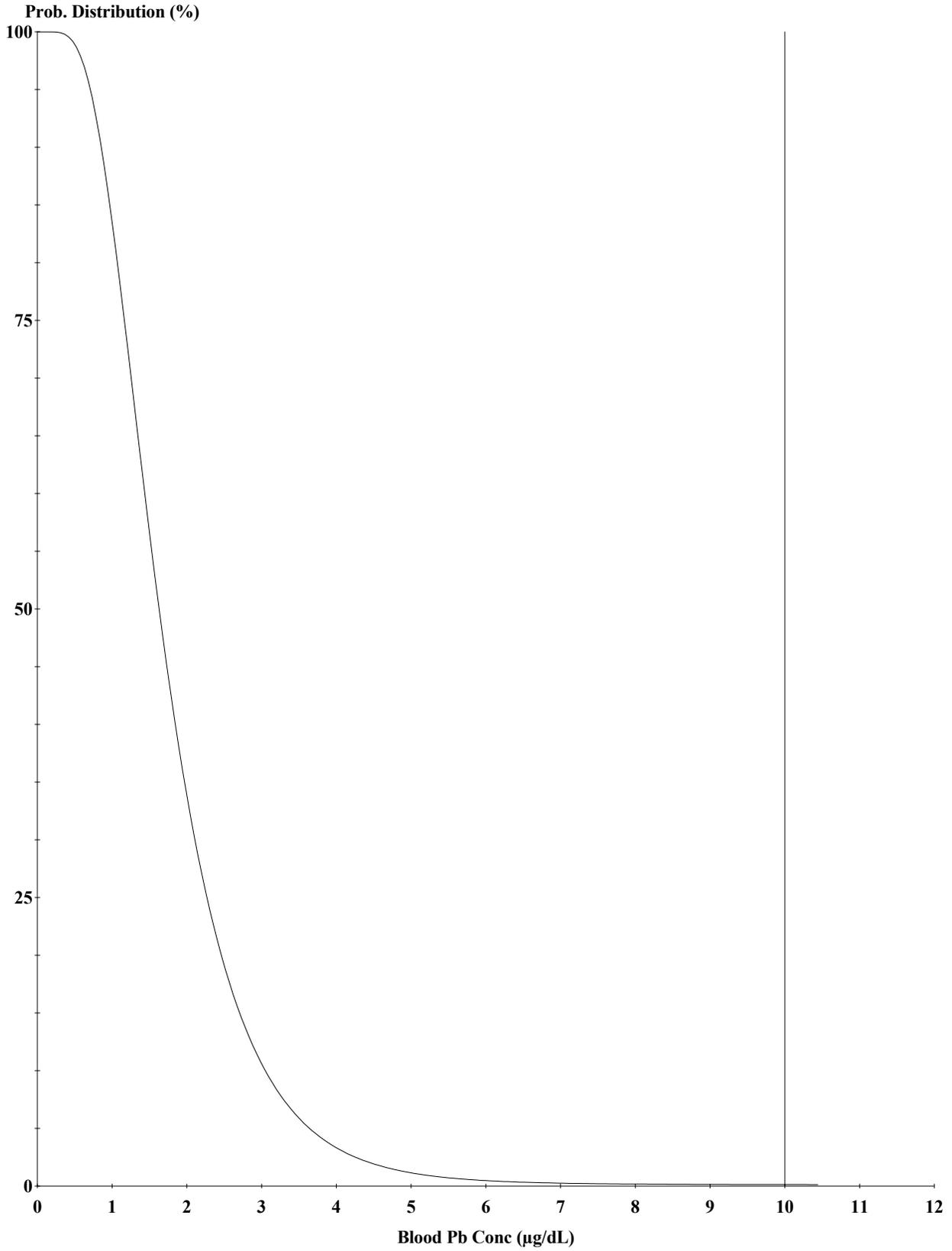
**Cutoff = 5.000 µg/dl**  
**Geo Mean = 1.708**  
**GSD = 1.600**  
**% Above = 1.114**  
**USFS Camper**

**Age Range = User Designated: Ages 12 - 72 months**  
**Run Mode = Research**



**Cutoff = 8.000 µg/dl**  
**Geo Mean = 1.708**  
**GSD = 1.600**  
**% Above = 0.051**  
**USFS Camper**

**Age Range = User Designated: Ages 12 - 72 months**  
**Run Mode = Research**



**Cutoff = 10.000 µg/dl**  
**Geo Mean = 1.708**  
**GSD = 1.600**  
**% Above = 0.008**  
**USFS Camper**

**Age Range = User Designated: Ages 12 - 72 months**  
**Run Mode = Research**

# Appendix F

## Screening-Level Acute Risk Evaluation

### 1.0 Introduction

Because acute screening levels are not readily available for evaluating Site media, acute screening levels were derived for lead and arsenic in soil/waste rock based on a camping exposure scenario. Soil/waste rock were evaluated because they represent the majority of exposure for a receptor; exposure to surface water is considered minor relative to solid media exposure. Lead and arsenic were selected for evaluation because soil concentrations are notably elevated at several locations within the mining districts and both are often important human health risk drivers for mining-related contamination. The camping scenario was selected for the derivation of acute screening levels because the camper is anticipated to be the most sedentary of receptors (i.e., not moving about being exposed to a variety of soil/mine waste sources, in contrast with hiker, hunter, fisherman, all-terrain vehicle rider/guide, and road worker receptors). Derivation of screening levels for a sedentary receptor allows for the application of these screening levels to smaller exposure areas, such as individual campgrounds and dispersed areas suitable for camping.

Focus was placed on evaluating acute exposures to children because children are often more vulnerable to pollutants than adults due to differences in behavior and biology that can lead to greater exposure and/or unique windows of susceptibility during development. Additionally, soil ingestion rates for young children are higher than adults due to increased frequency of contact through hand-to-mouth or object-to-mouth activity. Thus, exposure parameters used in the derivation of the acute screening levels were tailored for children two years of age. Two exposure scenarios for a child that may camp within the mining districts were evaluated:

- Scenario 1: Child, based on central tendency exposure (CTE) soil intake rates specific to a camping exposure scenario
- Scenario 2: Child, based on reasonable maximum exposure (RME) soil intake rates specific to a camping exposure scenario

The derivation of, and differences between, exposure estimates for these two scenarios are described further below. Section 2.1 describes the approach for lead and Section 2.2 describes the approach for arsenic.

### 2.0 Derivation and Application of Acute Screening Levels

As noted above, acute screening levels have been developed for two exposure scenarios resulting in a range of acute screening levels for consideration in risk management decision-making. The sections below present the approach and assumptions used in the derivation of the acute screening levels for lead and arsenic for application to soil/waste rock.

Acute screening levels were developed based on exposure durations of 2 days and 14 days. An exposure duration of 2 days represents a camping duration of a weekend, while 14 days represents the maximum allowable time that may be spent camping in one location in the national forest (U.S. Forest Service [USFS] 2018).

## 2.1 Lead

The U.S. Environmental Protection Agency (EPA) recommends the use of the Integrated Exposure Uptake Biokinetic (IEUBK) model to evaluate exposures from lead-contaminated media in children in a residential setting for continuous exposure of sufficient duration to result in a quasi-steady state (EPA 1994). The IEUBK model was not designed to assess short-term (less than 90 days), periodic (less frequent than one exposure per week), or acute (less than or equal to 14 days) exposures (EPA 2016). Because of this, an alternate model was selected to evaluate acute exposure to lead from a short-term camping scenario. EPA has recommended the use of the All Ages Lead Model (AALM) for evaluating short-term exposure scenarios (EPA 2016). The AALM is still in development, however, a beta version (FORTRAN 1.0) of this model is available (upon EPA request) and was used in researching effects of lead exposures at various life stages to support the development of the acute screening levels. The version of the model used to derive acute lead screening levels in this appendix was provided by EPA on November 16, 2018.

The AALM was used to evaluate a “pulse” exposure occurring for either 2 days or 14 days, by a child due to incidental ingestion of soil/waste rock encountered at a specific location (e.g., campground or other suitable area for camping). The model output includes predicted lead concentrations in various body compartments including the blood, plasma, kidney, liver, bone, etc. for specified time step intervals (e.g., daily) with interpolated changes between steps. The AALM was run using a time step of 0.01 days to allow for maximum precision. This output can be used to determine peak blood lead (PbB) concentrations following a pulse exposure.

**Table F-1** presents the general input parameters used to derive the acute screening levels for lead, recognizing that several of the assumptions may differ from those typically used in an evaluation of chronic exposure to lead.

**Table F-1. General Parameters Used to Calculate the Acute Lead Screening Levels**

| Parameter                                   | Value                    | Source                        |
|---------------------------------------------|--------------------------|-------------------------------|
| Target PbB level (µg/dL)                    | 19.5                     | EPA 2016                      |
| Maternal PbB level (µg/dL)                  | 0.6                      | EPA 2017b                     |
| Default drinking water concentration (µg/L) | 0.9                      | EPA 2017a                     |
| Background soil lead concentration (mg/kg)  | 100                      | Site-specific Scribe database |
| Air lead concentration (µg/m <sup>3</sup> ) | 0.10                     | IEUBK default                 |
| Dust lead concentration (mg/kg)             | 0.7 * soil concentration | IEUBK assumption              |
| RBA (dispersed campsite soil)               | 0.54                     | Site-specific average         |
| RBA (waste rock)                            | 0.23                     | Site-specific average         |
| Receptor gender                             | Female                   | AALM model                    |

mg/kg – milligrams per kilogram

PbB – blood lead

RBA – relative bioavailability

µg/dL – micrograms per deciliter

µg/L – micrograms per liter

The rationale for the selection of each input provided in **Table F-1** is presented below:

- Target PbB level – An acute blood lead threshold of 20 micrograms per deciliter (µg/dL) was identified in Office of Land and Emergency Management (OLEM) Directive 9285.6-54, *Recommendations for Assessing Short-term Exposure Involving Lead at Superfund Sites* (EPA 2016). Per EPA (2016), a PbB level of 20 µg/dL could be considered as a short-term elevation in PbB that would trigger a response action. This is based on the interpretation of the Center for Disease Control (CDC) recommendation that PbB levels in the range of 20 to 44 µg/dL would result in a home visit by a public health agency within 24 hours of a referral from a physician (CDC 2012). For the purposes of this evaluation, 19.5 µg/dL was selected as target PbB for establishing an acute screening level, to account for rounding to two significant digits.
- Maternal PbB level – A maternal PbB level of 0.6 µg/dL was selected based the recommendation provided in OLEM Directive 9285.6-56 (EPA 2017b).
- Default drinking water concentration – A default lead drinking water concentration of 0.9 micrograms per liter (µg/L) was selected based the value used in the *Headquarters Lead Consultation Intake Form for the Colorado Smelter Superfund Site* (EPA 2017a).
- Background soil lead concentration – A background soil lead concentration of 100 milligrams per kilogram (mg/kg) was selected based on the mean soil lead concentration measured in upland reference soil collected within the mining districts.
- Air lead concentration – The default outdoor air lead concentration of 0.1 µg/m<sup>3</sup> in the IEUBK model was selected.
- Dust lead concentration – The background dust concentration was assumed to be 70% of the concentration in soil (i.e., 100 mg/kg · 0.7 = 70 mg/kg), as is usually assumed in the IEUBK model.
- Relative bioavailability (RBA) – Lead RBA was determined by measuring in vitro bioaccessability for campsite soil and waste rock samples collected within the mining districts. The mean estimate of RBA for lead was 0.54 and 0.23 for campsite soil and waste rock, respectively. Because of the variability between the mean RBA values for campsite soil and waste rock samples, screening levels were developed for each media type using their respective RBA values.
- Receptor gender – A female receptor was selected because female children have a lower body weight than male children (per default inputs in the AALM). A receptor with a lower body weight is more sensitive to exposure compared to a receptor with a higher body weight.

**Table F-2** presents the scenario-specific input parameters used to derive the acute screening level for lead.

**Table F-2. Scenario-Specific Parameters Used to Calculate the Acute Lead Screening Levels**

| Parameter                                             | Scenario 1<br>CTE Camping | Scenario 2<br>RME Camping | Source               |
|-------------------------------------------------------|---------------------------|---------------------------|----------------------|
| Soil intake rate during pulse exposure (g soil/day)   | 0.367                     | 1.592                     | EPA 2008 (Table 5-6) |
| Soil intake rate prior to pulse exposure (g soil/day) | 0.094                     | 0.094                     | EPA 2017a            |
| Water intake rate (L water/day)                       | 0.51                      | 0.51                      | EPA 2017a            |
| Diet intake rate ( $\mu\text{g Pb/day}$ )             | 5.21                      | 5.21                      | EPA 2017a            |
| Receptor age at first pulse exposure                  | 2 years old<br>(730 days) | 2 years old<br>(730 days) | EPA 2008 (Table 5-6) |

CTE – central tendency exposure

g – grams

L – liters

Pb – lead

RME – reasonable maximum exposure

$\mu\text{g}$  – micrograms

The rationale for the selection of each input provided in **Table F-2** is presented below:

- Soil intake rate during pulse exposure – Soil intake rates were selected for use in the model to present a range of acute screening levels. In each case, the most conservative soil intake rate available for each scenario was selected so that the most sensitive receptor was used in the model.
  - Scenario 1 – The soil intake rate selected for a CTE child while camping was 0.367 g/day because this is the highest geometric mean intake rate provided in the *Child-Specific Exposure Factors Handbook* (EPA 2008, Table 5-6). This value corresponds to a 2-year-old to 3-year-old girl. The study upon which this value is based evaluated soil intake using a tracer element methodology for 78 children aged 1 to 5 years old at campgrounds (Van Wijnen et al. 1990).
  - Scenario 2 – The soil intake rate selected for an RME child while camping was 1.592 g/day because this is the 95<sup>th</sup> percentile (computed using the reported geomean and geometric standard deviation) for the intake rates provided for the 2-year-old to 3-year-old girl (EPA 2008, Table 5-6).
- Soil intake rate prior to pulse exposure – The soil intake rate prior to the pulse selected for use in the model was the soil intake rate provided in the *Headquarters Lead Consultation Intake Form for the Colorado Smelter Superfund Site* (EPA 2017a) for the age group prior to the pulse. The soil intake rate prior to pulse was 0.094 g/day (soil intake rate for a 1-year old to 2-year old).
- Water intake rate – The drinking water intake rate selected for use in the model was 0.51 liters per day (L/day), based the values provided in the *Headquarters Lead Consultation Intake Form for the Colorado Smelter Superfund Site* (EPA 2017a).

- Dietary intake rate – The dietary lead intake rate selected for use in the model was 5.21 micrograms per day ( $\mu\text{g}/\text{day}$ ), based the values provided in the *Headquarters Lead Consultation Intake Form for the Colorado Smelter Superfund Site* (EPA 2017a).
- Receptor age at first pulse exposure – The age at first pulse exposure was 730 days (2 years old).

**Table F-3** presents the acute screening levels for lead based on a 2-day and 14-day exposure to soil/waste rock that were derived based on the inputs provided in the tables above and for the scenarios that have been described. The acute screening levels were derived by determining the soil/waste rock concentration that would result in a predicted peak PbB concentration of 19.5  $\mu\text{g}/\text{dL}$ .

**Table F-3. Acute Lead Screening Levels (mg/kg)**

**Panel A. Dispersed Campsite Soil (RBA = 0.54)**

| Scenario   | 2 Day Exposure | 14 Day Exposure |
|------------|----------------|-----------------|
| Scenario 1 | 2,594          | 1,331           |
| Scenario 2 | 596            | 306             |

**Panel B. Waste Rock (RBA = 0.23)**

| Scenario   | 2 Day Exposure | 14 Day Exposure |
|------------|----------------|-----------------|
| Scenario 1 | 6,090          | 3,125           |
| Scenario 2 | 1,400          | 719             |

mg/kg – milligrams per kilogram

As seen in **Panel A** and **Panel B** in **Table F-3**, the change in screening level is inversely proportional to the change in RBA; decreasing the RBA by a factor of 2.35 increases the screening level by 2.35.

For demonstration purposes, **Figure F-1** presents a graphical display of the predicted PbB concentrations based on the acute screening levels for waste rock developed for a 2-day and 14-day exposure for Scenario 1 (CTE). As seen, the predicted PbB concentrations rise sharply for the 2-day exposure to soils containing 6,090 mg/kg to reach 19.5  $\mu\text{g}/\text{dL}$ . In contrast, the predicted PbB concentrations have a more gradual rise for the 14-day exposure to soils containing 3,125 mg/kg to reach 19.5  $\mu\text{g}/\text{dL}$ .

A comparison of the applicable lead screening levels to data collected from campgrounds and waste rock was performed. The lead soil concentrations used in the evaluation were based on the fine (250- $\mu\text{m}$ ) size fraction. An adjustment factor was applied to estimate the fine fraction from the 2-mm result (EPA 2000, 2017a). The adjustment factor was determined by performing a regression analysis of the lead results for samples sieved to 2-mm and to 250- $\mu\text{m}$ . The regression analysis is presented in Figure 5-1 in the main document. As shown, lead concentrations for the fine fraction were estimated as follows<sup>1</sup>:

<sup>1</sup> In order to be conservative, for cases where the predicted concentration of lead in soil for the fine fraction resulted in a value less than what was measured in the bulk fraction, the concentration in the bulk fraction

$$C_{\text{soil}, 250\text{-}\mu\text{m}} = 1.625 \cdot C_{\text{soil}, 2\text{-mm}} - 226.36$$

where:

$C_{\text{soil}, 250\text{-}\mu\text{m}}$  = Estimated lead concentration in soil for the fine (250- $\mu\text{m}$ ) fraction

$C_{\text{soil}, 2\text{-mm}}$  = Measured lead concentration in soil for the bulk (2-mm) fraction

**Figure F-2** presents the comparison of the applicable lead screening levels to samples collected from campgrounds/dispersed campsites<sup>2</sup> and waste rock. **Panel A** presents the comparison using a linear scale so that the magnitude of exceedances can be observed; **Panel B** presents the comparison using a log scale so that exceedances of screening levels can be seen easier. For the acute risk evaluation, exposure was evaluated for individual samples rather than assume that exposure occurs evenly across an exposure area as was done for the chronic risk evaluation. For campgrounds, the 14-day screening level was selected; for waste rock, the 2-day screening level was selected. Samples collected from waste rock areas are more remote (i.e., less accessible) and are not representative of areas that are frequently used for camping. Concentrations of lead in upland reference soil have also been included for comparison purposes. As seen, there are multiple campground samples with lead concentrations that exceed the 14-day CTE and RME screening levels. Samples collected from dispersed campsites 2, 3, 4, and 7 had the greatest exceedance margin. For waste rock, there were many samples that exceeded the 2-day CTE and RME screening levels. For the upland reference samples, there were a few exceedances of the RME screening level, but no exceedances of the CTE screening level as presented in **Figure F-2**.

## 2.2 Arsenic

Acute toxicity information is generally lacking for arsenic, and acute arsenic screening levels specific to the type of receptors present within the mining districts (i.e., recreational visitors) are not available. A review of *Toxicological Profile for Arsenic* developed by the Agency for Toxic Substances and Disease Registry (ATSDR) reveals oral doses as low as 0.02 to 0.06 milligrams of arsenic per kilogram body weight per day (mg/kg BW/day) have been reported to cause toxic effects in some individuals (ATSDR 1989). Severe exposures can result in acute encephalopathy, congestive heart failure, stupor, convulsions, paralysis, coma, and death. The acute lethal dose to humans has been estimated to be about 0.6 mg/kg BW/day (ATSDR 1989).

Washington State Department of Health (WSDOH) provides a synopsis of published scientific information related to soil exposure and acute toxicity in *Hazards of Short-term Exposure to Arsenic Contaminated Soil* (WSDOH 1999). The most sensitive reported indicators of acute toxicity appear to be edema, conjunctivitis, liver enlargement, irritation of the mucous membranes, and gastrointestinal problems such as vomiting, diarrhea, cramps, and pain. Transient adverse health effects commonly occur when doses between 0.035 and 0.071 milligrams of arsenic per kilogram of body weight (mg/kg BW) are ingested. The best estimate of an acute threshold for transient effects is 0.05 mg/kg BW. Using the acute transient effect dose

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was adopted. This situation occurs at low concentration levels because the fine fraction and the bulk fraction become approximately equivalent.

<sup>2</sup> A “dispersed” campsite is an area that is suitable for camping or where camping is known to occur but may not be a formal campground.

information, acute arsenic screening levels can be derived for the same two exposure scenarios that were evaluated for lead (see Section 2.1). The equation used to derive the acute arsenic screening level is as follows:

$$ASL_{As} = (ATE / SF) / (IR / CF_{IR} / BW \cdot ED \cdot RBA)$$

where:

|            |   |                                                    |
|------------|---|----------------------------------------------------|
| $ASL_{As}$ | = | Acute screening level for arsenic (mg/kg soil)     |
| ATE        | = | Acute transient effect dose (mg/kg BW)             |
| SF         | = | Toxicity safety factor (unitless)                  |
| IR         | = | Soil intake rate (g soil/day)                      |
| $CF_{IR}$  | = | Conversion factor for intake rate, convert g to kg |
| BW         | = | Body weight (kg)                                   |
| ED         | = | Exposure duration (days)                           |
| RBA        | = | Relative bioavailability                           |

When possible, consistent exposure parameters were used for arsenic and lead. **Table F-4** presents the general input parameters used to derive the acute screening levels for arsenic, recognizing that several of the assumptions may differ from those typically used in an evaluation of chronic exposures.

**Table F-4. General Parameters Used to Calculate the Acute Arsenic Screening Levels**

| Parameter                                               | Value  | Source                |
|---------------------------------------------------------|--------|-----------------------|
| Receptor gender                                         | Female | EPA 2008 (Table 8-10) |
| Acute transient effect dose (mg arsenic/kg body weight) | 0.05   | WSDOH 1999            |
| Toxicity safety factor (unitless)                       | 10     | WSDOH 1999            |
| RBA (disperse campsite soil)                            | 0.07   | Site-specific average |
| RBA (waste rock)                                        | 0.05   | Site-specific average |

mg– milligrams

kg – kilograms

RBA – relative bioavailability

The rationale for the selection of each input provided in **Table F-4** is presented below:

- Receptor gender – A female receptor was selected because female children have a lower body weight than male children (EPA 2008). A receptor with a lower body weight is more sensitive to exposure compared to a receptor with a higher body weight.
- Acute transient effect dose – The best estimate acute transient effect dose was selected to represent the dose at which edema, conjunctivitis, liver enlargement, irritation of the

mucous membranes, and/or gastrointestinal problems (vomiting, diarrhea, cramps, and pain) may occur (WSDOH 1999).

- Toxicity safety factor – A no-effect level is typically estimated by dividing the dose observed to cause health effects by a safety factor. There is little scientific information available to guide the selection of a safety factor for short-term exposure to arsenic in soil. The selection must be based on judgement of the margin of safety desired for protection from the potential adverse consequences of this type of event. For the two scenarios, a safety factor of 10 was considered adequate to estimate a no-effect level from an acute effect level for the purposes of calculating soil arsenic concentrations protective of human health. This choice was based on consideration of documented variability in human sensitivity to the toxic effects of arsenic as well as consideration of likelihood of occurrence of the various scenarios (WSDOH 1999).
- RBA – Arsenic RBA was determined by measuring in vitro bioaccessability for dispersed campsite soil and waste rock samples collected within the mining districts. The mean estimate of RBA for arsenic was 0.07 and 0.05 for dispersed campsite soil and waste rock, respectively. Screening levels were developed for each media type using their respective RBA values.

**Table F-5** presents the scenario-specific input parameters used to derive the acute screening level for arsenic.

**Table F-5. Scenario-Specific Parameters Used to Calculate the Acute Arsenic Screening Levels**

| Parameter                                     | Scenario 1<br>CTE Camping | Scenario 2<br>RME Camping | Source                |
|-----------------------------------------------|---------------------------|---------------------------|-----------------------|
| Soil intake rate during exposure (g soil/day) | 0.367                     | 1.592                     | EPA 2008 (Table 5-6)  |
| Receptor age at exposure                      | 2 years old               | 2 years old               | EPA 2008 (Table 5-6)  |
| Receptor body weight (kg)                     | 12.5                      | 12.5                      | EPA 2008 (Table 8-10) |

CTE – central tendency exposure

g – grams

kg – kilograms

RME – reasonable maximum exposure

The rationale for the selection of each input provided in **Table F-5** is presented below:

- Soil intake rate during pulse exposure – Similar to the approach for deriving acute screening levels for lead, multiple soil intake rates were selected for use in the calculations to present a range of acute screening levels. In each case, the most conservative soil intake rate available for each scenario was selected so that the most sensitive receptor was used in the calculations. The soil intake rates used for arsenic are the same as those selected for lead during the pulse exposure. See Section 2.1 for the basis of the selected soil intake values for each scenario.
- Receptor age at exposure – Similar to the approach for deriving acute screening levels for lead, the age at exposure was 2 years old.

- Receptor body weight – The receptor body was selected to correlate to the age and gender of the receptor. The mean female body weight for a 2-year old was selected (EPA 2008, Table 8-10).

**Table F-6** presents the acute screening levels for arsenic based on a 2-day and 14-day exposure to soil/waste rock that were derived based on the inputs provided in the tables above and for the scenarios that have been described.

**Table F-6. Acute Arsenic Screening Levels (mg/kg)**

**Panel A. Dispersed Campsite Soil (RBA = 0.07)**

| Scenario   | 2 Day Exposure | 14 Day Exposure |
|------------|----------------|-----------------|
| Scenario 1 | 1,216          | 174             |
| Scenario 2 | 280            | 40              |

**Panel B. Waste Rock (RBA = 0.05)**

| Scenario   | 2 Day Exposure | 14 Day Exposure |
|------------|----------------|-----------------|
| Scenario 1 | 1,703          | 243             |
| Scenario 2 | 393            | 56              |

mg/kg – milligrams per kilogram

RBA – relative bioavailability

As seen, the change in screening level is inversely proportional to the change in RBA; decreasing the RBA by a factor of 1.4 increases the screening level by 1.4.

Review of the available campsite and waste rock data for arsenic was performed. **Figure F-3** presents a comparison of the applicable arsenic screening levels to samples collected from campgrounds/dispersed campsites and waste rock. **Panel A** presents the comparison using a linear scale so that the magnitude of exceedances can be observed; **Panel B** presents the comparison using a log scale so that exceedances of screening levels can be seen easier. For the acute risk evaluation, exposure was evaluated for individual samples representative of individual campgrounds rather than assume that exposure occurs evenly across campsites within an exposure area as was done for the chronic risk evaluation. Similar to the acute evaluation for lead, the 14-day screening level was selected for application to campgrounds; for waste rock, the 2-day screening level was selected. Concentrations for upland reference soil samples are also included in **Figure F-3** for comparison to the screening levels. For campground soil samples, concentrations of arsenic do not exceed the CTE screening levels, but there were some locations with soil concentrations greater than the RME screening level. For waste rock, there were four samples (collected from the Koehler Mine, Junction Mine, and Longfellow Mine) that exceeded the CTE screening level and three additional samples that exceeded the RME screening level. For all upland reference soil samples, the concentrations of arsenic observed are below the range of possible screening levels.

### 3.0 Uncertainty Assessment

Similar to the chronic risk evaluation, quantitative evaluation of acute risks to humans from environmental contamination is limited by uncertainty regarding a number of key data items, including concentration levels in the environment, the true level of human contact with

contaminated media, and the true acute effects in humans. This uncertainty is usually addressed by making assumptions or estimates for uncertain parameters based on whatever limited data are available. Because of these assumptions and estimates, the results of the acute evaluation are uncertain, and it is important for risk managers and the public to keep this in mind when interpreting the results of this evaluation. The following sections review the main sources of uncertainty.

### 3.1 Relative Bioavailability

An assumed average bioavailability was used in deriving the screening levels. Sample-specific bioavailability could be either higher or lower. For lead, sample-specific bioavailability was measured at the four campsite locations with the highest lead concentrations. The RBA for these locations ranged from 37% to 59%. Applying a sample-specific bioavailability would not change the conclusion that these locations are above both the 2-day and 14-day screening level.

For arsenic, there were several locations that exceeded the CTE screening level using the average RBA. Because sample-specific RBA information is not available at these locations, it is not possible to determine if use of this information would alter conclusions. With the exception of one sample collected from the Junction Mine, an alternate RBA value would not have the potential to change the conclusions because concentrations of arsenic are significantly above the screening level. If the sample-specific RBA for the Junction Mine were available and the RBA was lower, it would be possible that this sample could be below the CTE screening level.

### 3.2 Background Lead Concentration

The derivation of the lead screening levels required an assumed background concentration for lead in soil. Site-specific measurements of lead in upland reference soil indicate average lead concentrations in the mining districts is 100 mg/kg. Campers that may visit the mining districts may be exposed to soil with concentrations of lead that are higher or lower than this value when they are not visiting the Site (e.g., when they are at their residence) resulting in a different baseline blood lead level than was assumed for this acute evaluation.

### 3.3 AALM Model

The AALM model used to derive the lead screening levels is currently undergoing testing, therefore, screening levels derived using the model could require revision in the future if adjustments are made to the model. However, at this time, this is the best model available to evaluate acute lead exposure. The model incorporates time-varying media concentrations, media intake rates, and relative absorption factors to estimate total inhalation and total ingestion uptakes at each model time step. As part of coding and testing the AALM, a number of datasets were simulated, including adult and childhood datasets used during the original Leggett code calibration and validation. Additional datasets identified during a literature search were also included in coding and testing. Based on these tests, parameters with the AALM were adjusted by the model developers to ensure the best overall fit against all datasets (ICF 2016).

### 3.4 Exposure Assumptions

Screening levels were developed for a range of exposure durations and intake rates. **Figure F-2** and **Figure F-3** present screening levels for campgrounds based on a 14-day exposure and screening levels for waste rock based on a 2-day exposure. Acute exposure duration and soil

ingestion rates are likely to be variable. A camper could spend between 1 to 14 days in one location based on the maximum allowable number of days specified in USFS guidelines (USFS 2018). This exposure duration also considers the annual limit of 14 days for use of Bureau of Land Management land for dispersed camping. This maximum exposure duration combined with RME soil ingestion rates may result in overly conservative screening levels.

## 4.0 Conclusions

The screening levels for lead and arsenic presented in this appendix are to be considered in risk management decision-making within the mining districts. A range of values have been provided based on the understanding there may be differences in the applicable exposure scenario depending upon the type of location being evaluated. Evaluation of the locations from which samples were collected is a critical step in the risk management decision process. For example, the 2-day exposure screening levels may be more applicable to remote areas that are more difficult to access, whereas the 14-day exposure screening levels may be more applicable to dispersed campsites with that are easily accessible. In addition, when applying the screening levels, the physical attributes of the location from which samples have been collected should be considered. For example, samples collected from a steep slope are not representative of areas where camping may occur. Application of the screening levels to these areas would be inappropriate.

### 4.1 Lead

For the camping area soils, there are multiple samples with lead concentrations that exceed the 14-day CTE and RME acute screening levels. Because it may be unreasonable to assume that RME soil ingestion rates, which are specific to a camping scenario, are realistic for 14 days, it may be more appropriate to focus on samples that exceed the CTE acute screening level. Given this consideration, samples collected from dispersed campsites 2, 3, 4, and 7 had the greatest exceedance margin of the CTE screening level.

For waste rock, there were many samples that exceeded the 2-day CTE and RME acute screening levels. However, evaluation of the locations where samples were collected is a critical step in the risk management decision process. When evaluating samples in exceedance of the acute screening levels, the physical attributes of the location from which sample was collected should be considered. For example, samples collected from the steep slopes of a waste pile are not representative of areas where camping may occur. Thus, application of the acute camping screening levels to these areas would be inappropriate.

For the upland reference soils, there were a few exceedances of the RME screening level, but no exceedances of the CTE screening level. This indicates that lead concentration in areas at the Site that are not impacted by mining activities would not pose an acute risk to campers based on “typical” soil ingestion rates. However, if the soil ingestion rate were to be at an RME level for 14 consecutive days, acute risks have the potential to be unacceptable in upland reference areas. Because unacceptable exposures are not expected in unimpacted areas, this further supports the conclusion that the 14-day RME screening level is likely to be overly conservative. This should be taken into consideration during risk management decision-making.

## 4.2 Arsenic

For the camping area soil, concentrations of arsenic do not exceed the 14-day CTE acute screening levels, but there were some locations with soil concentrations greater than the RME screening level. For waste rock, there were four samples (collected from three mining areas, including the Koehler Mine, Junction Mine, and Longfellow Mine) that exceeded the 2-day CTE acute screening level and three additional samples that exceeded the RME screening level. For the upland reference soils, the measured arsenic concentrations are below the range of possible screening levels for all samples.

## 5.0 References

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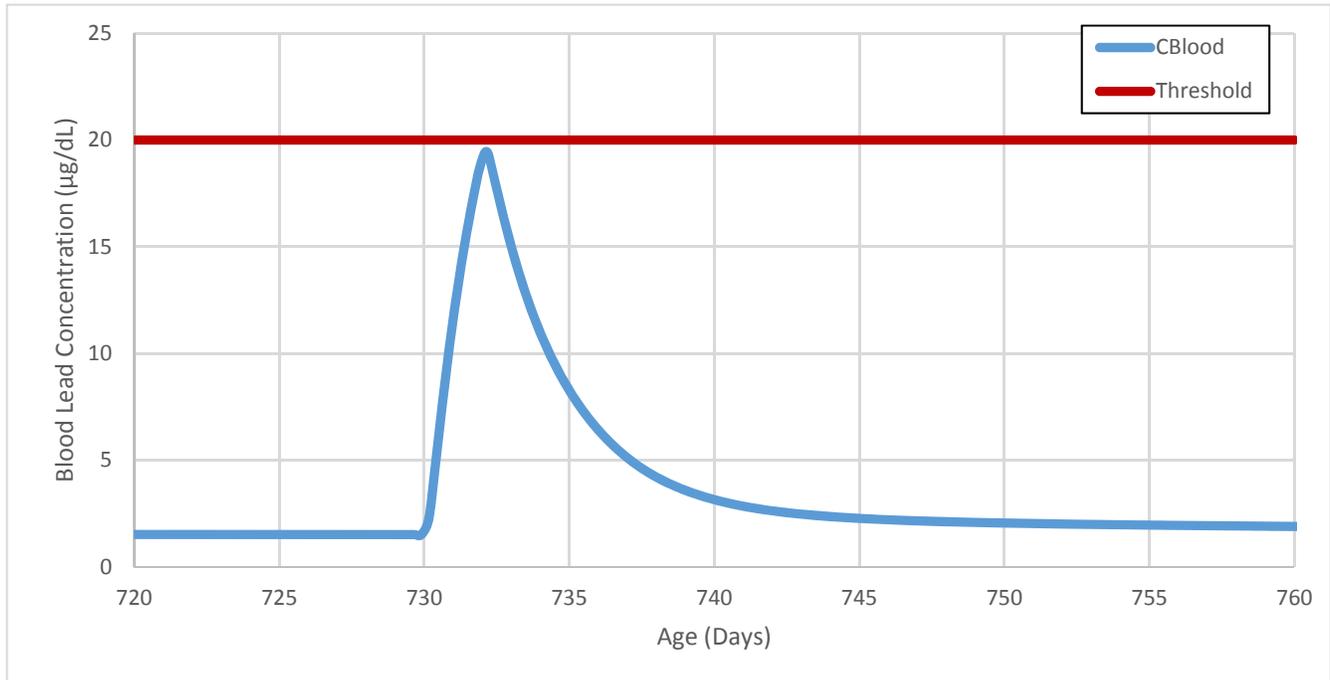
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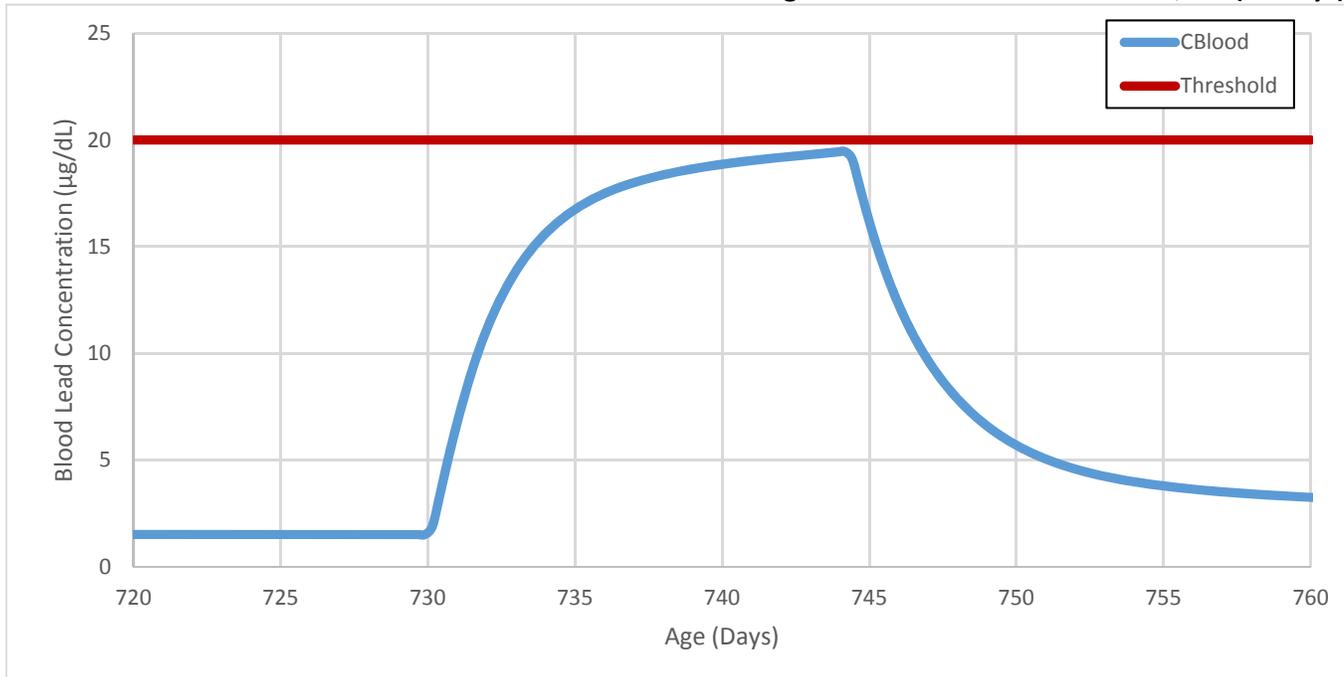
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**FIGURE F-1. EXAMPLE AALM OUPUT DATA – 2-DAY VERSUS 14-DAY EXPOSURE DURATION**  
**Bonita Peak Mining District**

**Panel A. Blood Lead Concentration for a 2-Year-Old Female - Single-Pulse Soil Concentration of 6,090 (2 Days)**



**Panel A. Blood Lead Concentration for a 2-Year-Old Female - Single-Pulse Soil Concentration of 3,125 (14 Days)**

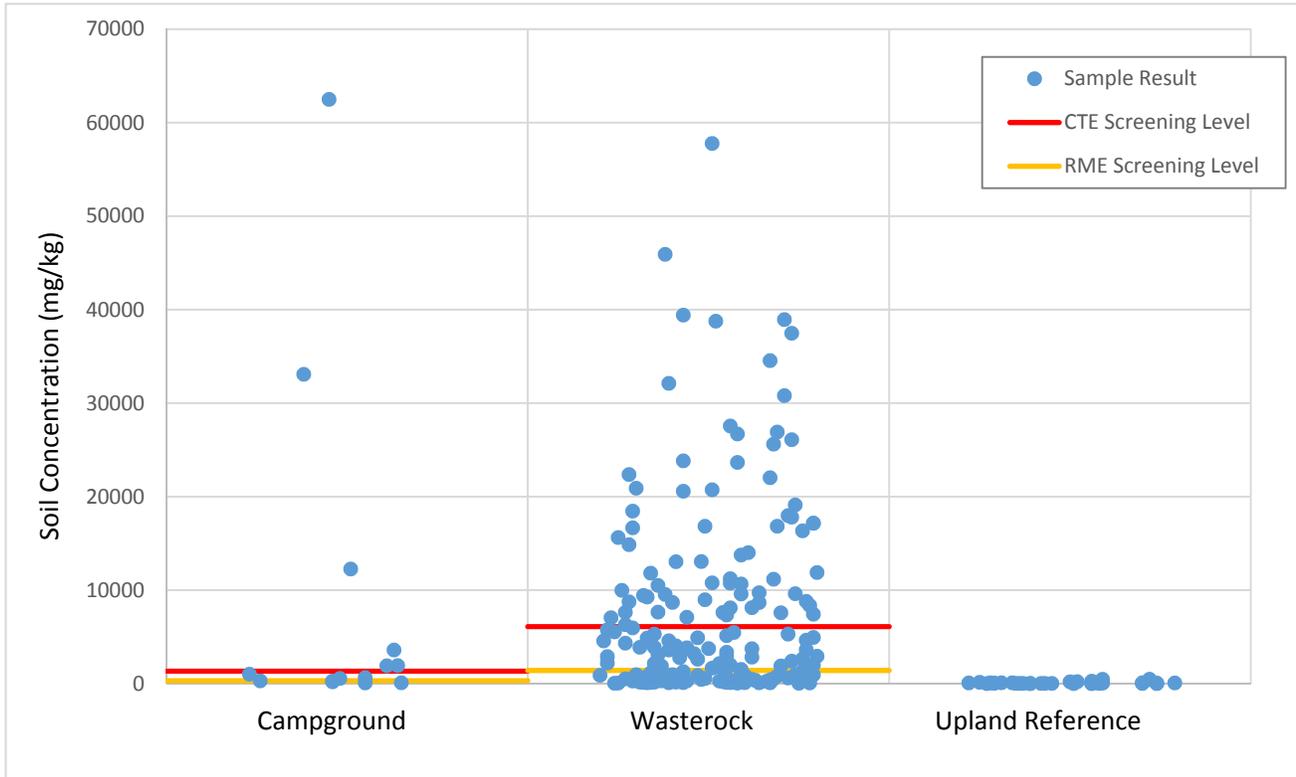


AALM - All Ages Lead Model  
 mg/kg - milligrams per kilogram  
 µg/dL - micrograms per deciliter  
 Cblood - concentration of lead in blood

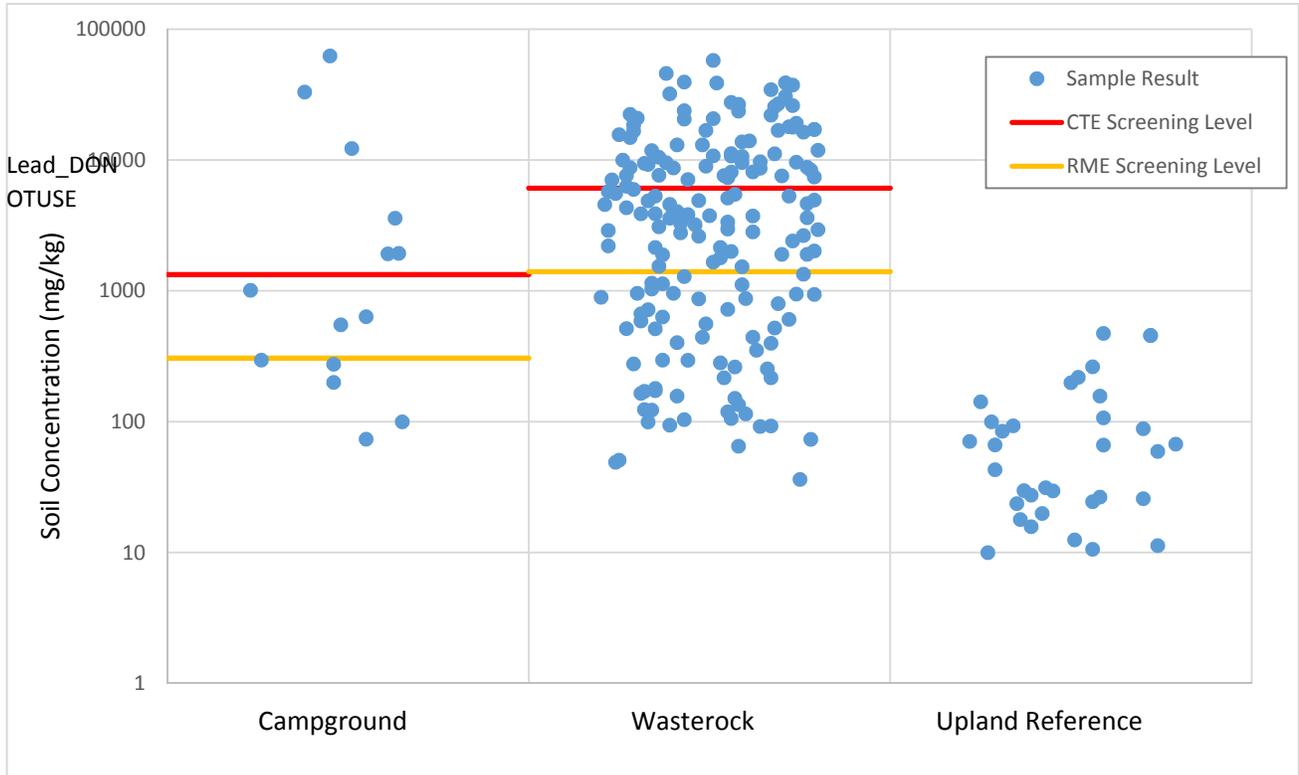
**FIGURE F-2. ACUTE SCREENING LEVEL COMPARISON TO SITE MATERIALS**

**Bonita Peak Mining District**

**Panel A. Linear Scale**



**Panel B. Log Scale**

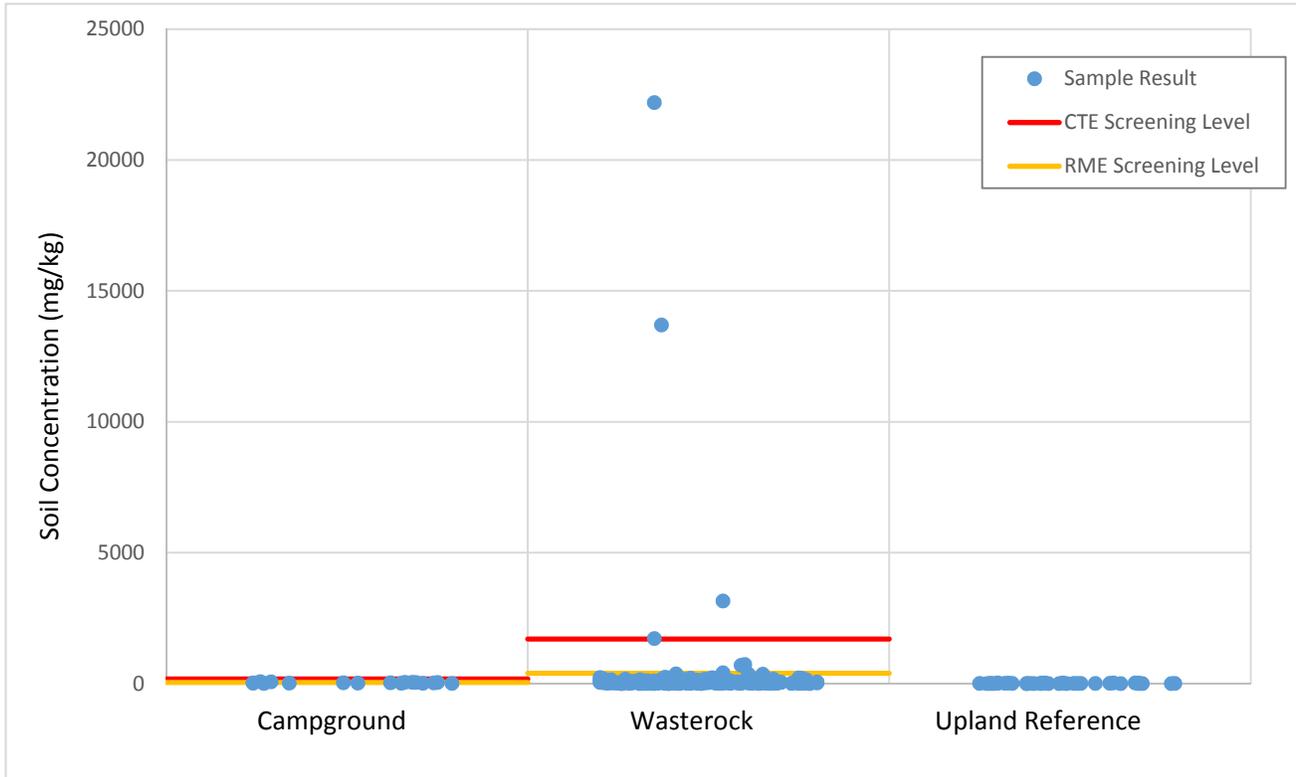


CTE - central tendency exposure  
RME - reasonable maximum exposure  
mg/kg - milligram per kilogram

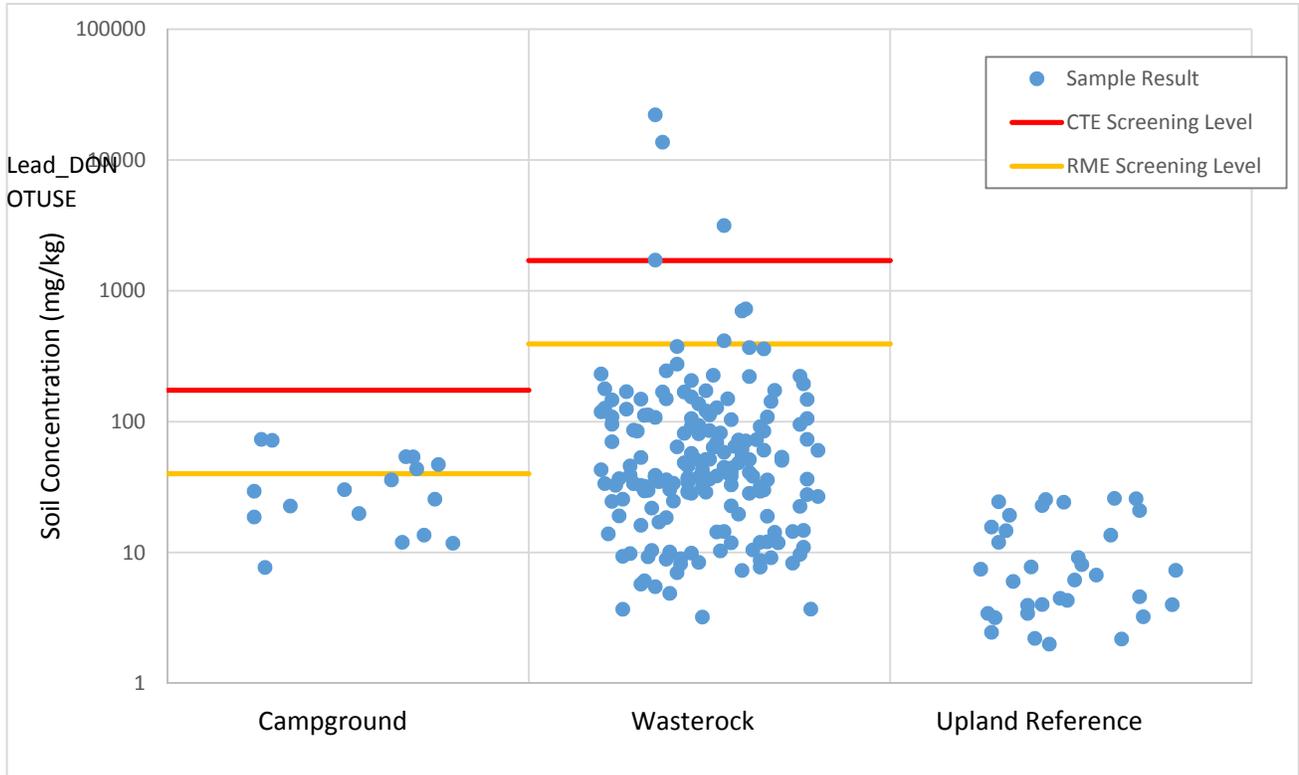
**FIGURE F-3. ACUTE SCREENING LEVEL COMPARISON TO SITE MATERIALS**

**Bonita Peak Mining District**

**Panel A. Linear Scale**



**Panel B. Log Scale**



CTE - central tendency exposure  
RME - reasonable maximum exposure  
mg/kg - milligram per kilogram